



# Standard Guide for Videoborecopying of Tubular Products for Sanitary Applications<sup>1</sup>

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## 1. Scope

1.1 This standard covers guidelines for ordering and examining tubular products for sanitary applications by videoborecopying. This method uses movable camera probe at the end of a cable to examine the interior of a tubular product. The image is then transmitted to an external monitor for analysis. The method is normally used when inside surface imperfections, not normally detected by other nondestructive methods, may result in contamination of the product which is contained by the tubular product.

## 2. Referenced Documents

### 2.1 ASTM Standards:

A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

## 3. Terminology

### 3.1 Definitions:

3.1.1 For definition of some of the terms used in this specification, refer to Specification A 941.

### 3.2 Other Definitions:

3.2.1 *collar*—a device which fits around the probe tip to control distance from the product surface and angle of viewing to ensure a consistent magnification factor.

### 3.3 Definitions of Terms Specific to This Standard:

3.3.1 *inclusion*—a nonmetallic particle embedded in the product surface.

3.3.2 *nick*—a surface imperfection resulting from material removal or compression usually caused by a mechanical means. It usually has a length to width ratio less than 5.

3.3.3 *oxide*—a darker, non-reflective area that is the result of improper protective gas coverage during a high temperature operation or insufficient chemical cleaning.

3.3.4 *pit*—a sharp edged surface depression usually caused by the removal of an embedded particle but may also be caused by selective metal removal by a chemical means.

3.3.5 *shrinkage*—a line of irregular shallow pores which occur along the center of a weld.

3.3.6 *scratch*—a long depression caused by a mechanical means. It usually has a length-to-width ratio greater than 5.

3.3.7 *slag pocket*—a pit, usually in a weld, caused by a particle of slag (metal oxides, carbides, fluorides or similar) which may have been cold worked into the surface. The pocket may or may not still contain slag during the examination.

3.3.8 *starburst*—a series of slag pockets where the center one is usually the largest and smaller ones radiate outward.

3.3.9 *tube*—a generic term for all tubular products including both pipe and tube.

## 4. Ordering Information

4.1 It is the responsibility of the purchaser to specify all of the requirements that are desired under this specification. Such requirements may include, but are not limited to, the following:

4.1.1 Number of tubes to be inspected.

4.1.2 The amount of probe to tube rotation, if desired (Section 8).

4.1.3 Any special probe coverage (Section 8).

4.1.4 Special probe feed rates (Section 8).

4.1.5 Any special acceptance criteria (Section 6).

4.1.6 Supply of recording tapes and whether traceability is required (Section 9).

4.1.7 Information to be identified on recording tapes (Section 9).

4.1.8 Whether customer witnessing is required (Section 10).

4.1.9 Whether Certification is required (Section 11).

## 5. Significance and Use

5.1 This specification establishes some of the key factors which govern the interpretation of videoborecopying tubular products for a specific application. It is recognized that the requirements for one application may be very different than those of another. Therefore, the specification allows for the inspection to be customized for the application by the user by allowing the purchaser to specify parameters which may be important for the application.

## 6. Acceptance Criteria

6.1 The purpose of this inspection is to identify imperfections on the ID surface of the tube which may be detrimental to the end use. These imperfections could have a variety of shapes, sizes and causes which may or may not have impact on

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the final use. The criteria should include a reference to the types of imperfections which are considered detrimental. These may include, but are not limited to, the following:

- 6.1.1 Nicks,
- 6.1.2 Scratches or other linear imperfections,
- 6.1.3 Pits,
- 6.1.4 Inclusions,
- 6.1.5 Slag pockets,
- 6.1.6 Starbursts,
- 6.1.7 Shrinkage,
- 6.1.8 Oxide,
- 6.1.9 Other weld imperfections.

6.2 Each imperfection shall be ranked by size. The criteria should include a listing of how many imperfections of a type and size are allowed per tube. It may include a listing which allows more, smaller imperfections of a type or fewer large ones. It may also include a maximum size which is allowed. The criteria may also define whether imperfections may contain deposits or not.

6.2.1 When properly calibrated, the length and width of the imperfection can be determined.

6.2.2 Imperfection depth is difficult to determine by this technique. When depth is a necessary part of the criteria, a representative sample should be agreed upon by the purchaser and supplier based upon the video image. This sample can then be sectioned and the depth measured by an alternative method.

6.3 Unless otherwise specified by the purchaser, the producer's published acceptance criteria shall be used. When no criteria exists, the acceptance criteria shall be negotiated prior to the start of testing.

## 7. Calibration

7.1 When imperfection sizing is part of the criteria, the videoboscope shall be calibrated prior to the examination. The following items affect sizing of imperfections for a particular unit:

7.1.1 Probe to surface distance. As the distance from the probe tip to the examined surface decreases, the magnification factor increases.

7.1.1.1 This distance shall be carefully controlled. This can be accomplished by fitting a collar to the tip of the probe which fits snugly into the inside diameter of the tube. The collar shall also have enough clearance to slide freely inside of the tube and be made of a material which will not cause additional unacceptable imperfections on the ID surface. The collar shall have sufficient length to prevent rocking of the probe which may hinder defect sizing.

7.1.2 Probe type,

7.1.3 Probe lens,

7.1.4 Display CRT. As the display screen increases, so does the magnification.

7.2 If any of the above four items, or any other factor which may affect magnification, is changed, the unit shall be recalibrated.

7.3 Calibration shall be performed using standards traceable to known National Standards, where they exist. Precision steel scales with .020" (0.5 mm) or finer graduations may be used for this calibration providing that the spacing between the

probe tip and scale is controlled to be the same as probe tip and examined surface distance.

## 8. Method of Scanning

8.1 The method and coverage of scanning, and care shall be related to the criticality of the application (See Notes 1-3).

NOTE 1—Scanning is usually considered as a sampling technique as the inside surface coverage is often less than 100%. As the amount of surface area per tube to be scanned increases, so does the potential for detecting an increasing number of imperfections. Therefore, as the amount of inspected surface area increases, so should the number of imperfections in the acceptance criteria for a tube of the same quality level.

NOTE 2—The videoboscoping technique is considered to be a relatively slow and expensive examination method. When deciding upon a scanning coverage and rate, the purchaser should recognize that higher coverages and slower path rates can increase the time of examination. This can have a significant impact on the overall time to perform the task and increase the cost. The purchaser should consider this when deciding upon these items.

NOTE 3—When surface finish may be critical to an application, such as those which use an electropolished finish, The user needs to choose coatings for the probe which do not damage the surface during the examination.

8.1.1 When a welded product is examined, unless otherwise specified by the purchaser, the examination shall be along the weld seam only.

8.1.2 The purchaser may specify if the examination path is linear or helical.

8.1.3 When desired, the purchaser may specify the maximum scanning rate which may be used. This is usually expressed as a tubular length per minute.

## 9. Recordings

9.1 When specified by the purchaser, recordings shall be made of the tube inspection. These are usually in the standard VHS format. The purchaser may specify if the recordings are to be from every tube or per a sample plan.

9.2 When traceability between tube and recording is required, the supplier shall provide a method to identify each tube to the recording. If special information is to be identified on these recordings, the purchaser shall include this in the purchase order.

9.3 If defect sizing is utilized for acceptance of the tube, the supplier shall identify the size of the video monitor used during the inspection.

## 10. Inspection

10.1 The inspector representing the purchaser shall have entry, at all times, to those areas where the inspection is being performed. The supplier shall afford the inspector all reasonable facilities to satisfy him that the material is being examined in accordance with this specification. The inspection shall be conducted so as not to interfere unnecessarily with the examination.

## 11. Certification

11.1 When required by the purchaser, the supplier shall furnish a statement that the material has been examined and has met all of the requirements of this specification and the customer purchase order.

## 12. Keywords

### 12.1 pipe; tube; tubular product; videoboreoscoping

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