



American Welding Society

The Practical Reference Guide for

Welding Inspection Management



Visual Inspection of Pressure Vessels and Pressure Piping

**THE PRACTICAL
REFERENCE GUIDE
for
WELDING INSPECTION MANAGEMENT—
Visual Inspection of Pressure Vessels
and Pressure Piping**

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AUTHOR NOTES

Visual inspection (VT) is one of the more important inspection methods used to ensure the quality of both new fabrication, as well as equipment and piping after some period of service. It is used in all industries, and should be considered as the basic inspection method prior to the selection of any other inspection method. A phrase that puts VT in the proper perspective follows:

"It has been shown repeatedly that an effective program of visual inspection, conducted by properly trained personnel, will result in the discovery of the vast majority of those defects which would otherwise be discovered later by some more expensive nondestructive test method."

Note the emphasis on proper training; without such training, the inspector often only *looks* at things without actually inspecting them, and critical discontinuities are often overlooked. It is to that end, the training of visual inspectors, that this Guide was prepared. Proper visual inspection requires inspector training in many disciplines and the training should be a continuous, ongoing process. New technologies useful to visual inspection are continuing to be developed, and these must be incorporated into the overall inspection efforts to optimize results.

It was once stated that, *"Inspectors must have been half crazy to have selected inspection as a lifetime career!"* While many of us may agree with that statement in part, most would agree that inspection is a very challenging and satisfying career path, and we remain quite proud to be called inspectors.

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Introduction

In one version of a perfect world of manufacturing, there are no inspectors. None are needed because each and every person in the workforce has been so thoroughly trained, possesses and applies all the necessary personal attributes, and is paid a reasonable salary such that all manufacturing mistakes are completely eliminated. Think of that perfect scenario: a manufacturing world without mistakes. Some of today's quality approaches reach for that ideal goal and have developed precepts that considerably reduce online inspection requirements. The concept of "continuous improvement" is an important part of that quest for perfection, and is found in many quality-concept documents.

One approach to quality is found in the documents, modified by American organizations, commonly referred to as ISO Standards. These often become the basis for "ISO Certification," which many manufacturing sites obtain and market as part of their quality program. In the U.S., these ISO quality program standards and guides are published under the combined authority of ANSI (American National Standards Institute), ISO (International Organization for Standards), and the ASQ (American Society for Quality), as "Q" documents. Two of these are Q9004-1, *Quality Management and Quality System Elements—Guidelines*, and Q9001, *Quality Systems—Model for Quality Assurance in Design, Development, Production, Installation, and Servicing* (see Figure 1). A thorough understanding of these two quality documents is very helpful in organizing a Quality Assurance program for fabrication companies. Additional ASQ documents covering fabrication quality are Q9002, *Quality Systems—Model for Quality Assurance in Production, Installation, and Servicing*, and Q9003, *Quality Systems—Model for Quality Assurance in Final Inspection and Test*. Their cost is minimal and can be obtained from the American Society for Quality, 611 East Wisconsin Avenue, Milwaukee, WI 53202.

However, as much as these new quality programs have improved quality in many areas, in our less-than-ideal, real world, there still remains a need for skilled inspectors. Most have seen various versions of the old saying, "People do what you inspect, not what you expect." While that statement appears to be quite cynical, many critical manufacturing efforts still follow that credo with great success. Inspection will continue to be a necessary skill for

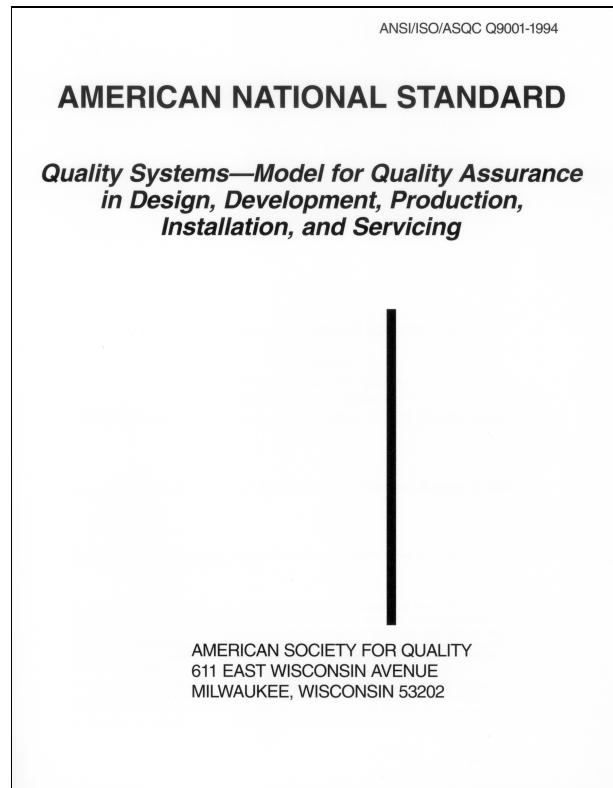


Figure 1. ANSI/ISO/ASQC Q9001-1994.

decades to come, especially in the fabricating industries, and visual inspection will certainly continue on the front line of that inspection effort.

In the broad field of Quality Assurance, the control of welding operations and fabrication of process equipment encompasses many technical disciplines including engineering design, materials selection, welding processes, welding procedures, non-destructive inspection, and corrosion mechanisms. Visual inspection plays an important role in all of these and it requires proper training of personnel to provide the necessary function of quality control at each stage of fabrication as well as continued inspections during the life of the component.

Inspector certification programs, such as the AWS CWI and SCWI certifications, have been developed to ensure a basic minimum qualification of the visual inspection personnel (see Figure 2). Other organizations such as the American Petroleum Institute (API), the National Association of Corrosion Engineers (NACE), and the American Society for Nondestructive Testing (ASNT), have developed