MPEG-4. This codec offers more efficient compression and is used in digital television and interactive media. MPEG-4 facilitates protection of intellectual property.[19]
MPEG-7. This codec specifies standardized metadata to enable search, tagging, cataloging and indexing.[20]
MPEG-21. This codec standardizes delivery across multiple platforms.[21]
MPEG-A. This codec integrates the features of its predecessors.[22]

Connectors

Table 5 lists several kinds of media for data transfer and storage.

Coaxial Cables[10]

Coaxial cable is used for transmission of analog or digital signals. In coaxial cables, a center conductor is surrounded by heavy dielectric insulation that is braided or foil shielded. The center-to-shield distance is controlled so that the impedance of the coaxial line matches the design load of the video circuitry feeding the signal. This matching minimizes losses and enables maximum power transfer. Most video coaxial cable has an impedance of 75 Ω.

TABLE 4. Digital formats and codecs of video files.

Designation	Format
Formats	
AVI	Audio Video Interleave
FLV	Shockwave Flash® file extension
MPEG	Moving Picture Experts Group, a standards body
MPEG 1	video format specification for compressing NTSC input
MPEG 2	video specification, compatible with analog interlacing
MPEG 3	video format specification
MPEG 4	video format specification
MP3	video format from MPEG 3
MP4	video format from MPEG 4
MOV	QuickTime® file extension
WME	Windows® Media Encoder
WMV	Windows® Media Video
SWF	Shockwave Flash®
VOB	video object, container format in DVD-Video media
WMF	Windows® metafile, native to Microsoft® software
Disk formats	
BD	Blu-Ray disk
CD	compact disk
DVD	digital video disk
ISO	extension for a file container that boots as virtual video disk

Ethernet

Ethernet cables are made of copper or fiber optic filaments and widely used for land based transmission of digital signals.[23] Ethernet was introduced as an upgrade to coaxial cable.

Thumb Flash Drives[10]

Thumb flash drives are convenient for plugging into a laptop for transfer of data or image files. In 2009, they use a universal serial bus connector and can be hung around the inspector's neck on a lanyard, attached to a key ring or kept in a pocket of the carrying case for a laptop computer. Inexpensive models in 2010 hold several gigabytes of data.

Universal Serial Bus (USB)

The universal serial bus is widely used for connected computer components. There are several generations and configurations of the bus. Four configurations developed by year 2010 are discussed below.

1. The USB 1.0 has a slow transfer speed of 1.5 megabytes per second and does not allow for streaming video. The USB 1.0 has been superseded by later designs.
2. Called *full speed,* the USB 1.1 has a transfer speed of 12 megabytes per second and allows for video transfer with an audio track. It has been widely used for most accessory devices in the first decade of the twenty-first century.
3. Called *high speed,* the USB 2.0 has a transfer speed of 480 megabytes per second and requires a correspondingly fast processor. It is backwardly compatible with USB 1.1 and uses the same connection.
4. Called *super speed,* the USB 3.0 has a transfer speed of 4.8 gigabytes per second and requires a correspondingly fast processor. It is backwardly compatible with most earlier USB devices and uses the same connection.

TABLE 5. Media for data storage.

Medium	Portability	Capacity
Floppy disk	poor	poor
Compact disk (CD)	good	good for images; poor for video
Digital video disk (DVD)	good	good
Blu-Ray™ disk (BD)	good	excellent
Flash™ drive	excellent	good for images; poor for video
External drive, cabled	awkward	excellent
External drive, wireless	connectivity limits	excellent

Hot tears appear on the surface as a ragged line of variable width and numerous branches. In some instances, the cracks are not detectable until after machining because the tearing can be subsurface.

Blowholes and Porosity

Gas porosities are rounded cavities (flattened, elongated or spherical) caused by the accumulation of gas bubbles in molten metal as it solidifies. A small percentage of these bubbles rise through the molten metal and escape. However, most are trapped at or near the surface of the ingot when solidification is complete. During rolling or forging of the ingot, some of these gas pockets are fused shut. The remaining pockets may appear as seams in the rolled ingot.

Blowholes are conical, wide at the surface and tapering internally. Deep blowholes not rolled shut may appear as laminations after becoming elongated in the rolling operation.

A surface condition resembling porosity is called *orange peel* because of its appearance (Fig. 5).

Nonmetallic Inclusions

Inclusions in ferrous alloys are usually oxides, sulfides or silicates either inherent in the base metal or introduced during the melting operation. These inclusions are caused by conversion of iron ore in the blast furnace. Dirty remelt, crucibles or rods or poor linings may introduce nonmetallic inclusions into the molten metal. Other contributing factors are poor pouring practice and inadequate gating design that can produce turbulence within the mold.

Nonmetallic inclusions in ingots can, after forging, become stress risers because of their shape, discontinuous nature and incompatibility with the surrounding material. In many applications, it is the presence of these inclusions that lowers the ability of a metal to withstand high impact, static or fatigue stresses. Moreover, the effect of inclusions depends on their size and shape, their resistance to deformation, their orientation relative to applied stress and the tensile strength of the material. Many inclusions can be of a more complex intermediate composition than their host materials and each grade and type of metal has its own characteristic inclusions.

Figure 3. Longitudinal section of two ingots, showing typical pipe and porosity: (a) detectable; (b) severe.

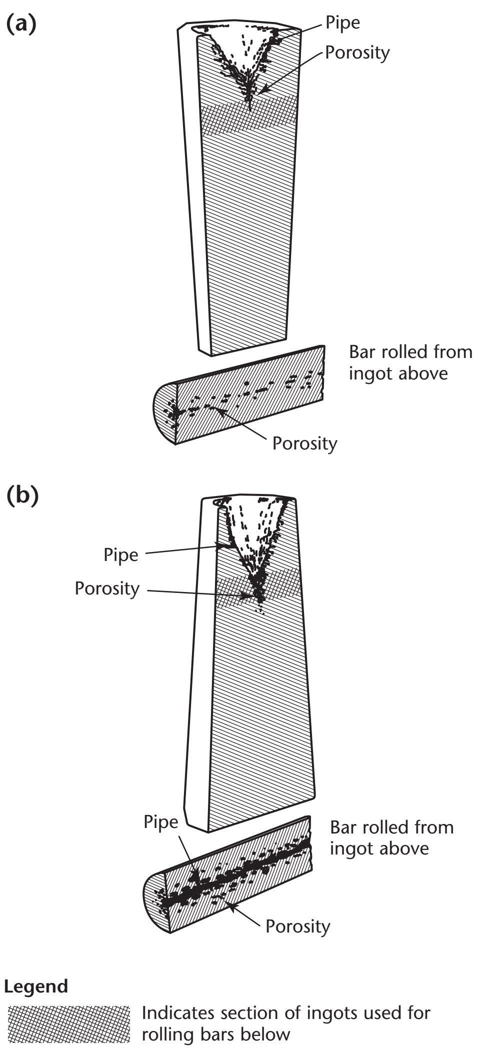
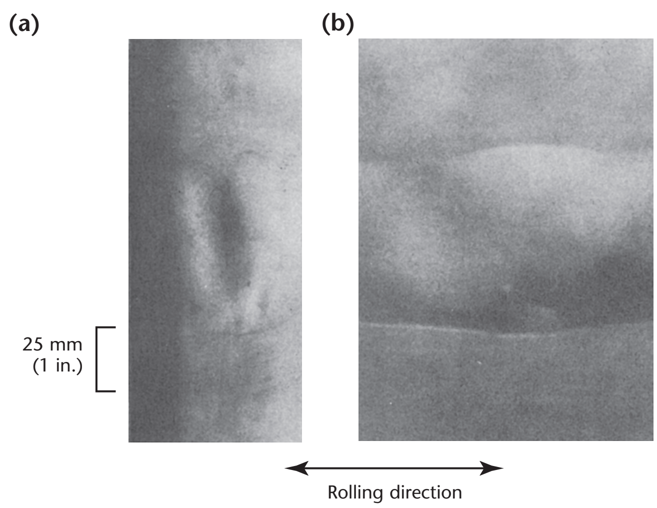


Figure 4. Pipe lamination is separation midway between surfaces containing oxide inclusions: (a) surface view; (b) internal section.



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10

CHAPTER

Electric Power Applications of Visual Testing

Richard T. Nademus, Exelon Corporation, Oyster Creek Generating Station, New Jersey (Part 2)

spectral transmittance: Radiant flux passing through a medium divided by the incident radiant flux.
spectrophotometer: Instrument used for spectrophotometry.
spectrophotometry: Measurement of electromagnetic radiant energy as a function of wavelength, particularly in the ultraviolet, visible and infrared wavelengths.
spectroradiometer: Instrument used for spectroradiometry.
spectroradiometry: Measurement of electromagnetic radiant power and spectral emittance, used particularly to examine colors and to measure the spectral emittance of light sources.
spectroscope: Instrument used for spectroscopy.
spectroscopy: Spectrophotometry or spectroradiometry in which the spectrum, rather than being analyzed only by a processing unit, is presented in a visible form to the operator for organoleptic examination.
spectrum: Representation of radiant energy in adjacent bands of hues in sequence according to the energy's wavelengths or frequencies. A rainbow is a well known example of a visible spectrum.
specular: Pertaining to a mirrorlike reflective finish, as of a metal. Compare *lambertian*.
specular reflection: When reflected waves and incident waves form equal angles at the reflecting surface.
speed of light: Speed of all radiant energy, including light, is $2.997\,924\,58 \times 10^8$ m·s^{-1} in vacuum. In all materials the speed is less and varies with the material's index of refraction, which itself varies with wavelength.[2,6]
speed of vision: Reciprocal of the duration of the exposure time required for something to be seen.[2,6]
standard: Object, document or concept established by authority, custom or agreement to serve as a model or rule in the measurement of quantity or the establishment of a practice or procedure.[4,8] See also *reference standard* and *acceptance standard*.
standardization, instrument: Adjustment of instrument readout before use to a specified reference value.[4]
standard observer response curve: See *eye sensitivity curve*.
steel: Iron alloy, usually with less than two percent carbon.
stereo photography: Close range photogrammetric technique involving the capture and viewing of two images of the same object in order to reconstruct a three dimensional image of the object.
stick welding: See *shielded metal arc welding*.
strain: Deflection or alteration of the shape of a material by external forces.
stress: (1) In physics, the action in a material that resists external forces such as tension and compression. (2) Load per unit of area.
stress concentration: Region where force per unit area is elevated, often because of geometric factors or cracks. Also known as a *stress raiser*.
stress raiser: Contour or property change that locally increases stress magnitude.
stress riser: See *stress raiser*.
stringer: In wrought materials, an elongated configuration of microconstituents or foreign material aligned in the direction of working. Commonly, the term is associated with elongated oxide or sulfide inclusions in steel.
subcase fatigue: Fatigue originating below the case depth.
subcase origin fatigue: See *subcase fatigue*.
subsurface fatigue: Fatigue cracking that originates below the surface. Usually associated with hard surfaced or shot peened parts but may occur any time subsurface stresses exceed surface stresses.

T

tarasov etching technique: Way of visually inspecting for the presence of deleterious effects in hardened steels by using specific etching solutions and methods of inspection.
temperature diagram: See *time temperature transformation (TTT) diagram*.
tempering: Process of heating a material, particularly hardened steel to below the austenite transformation temperature, to improve ductility.
tertiary creep: Third stage of creep, marked by steady increase in strain to the point of fracture under constant load.
test object: Physical part or specimen subject to nondestructive testing.
threshold: (1) A value in a phenomenon where a large change of output occurs. (2) Setting of an instrument that causes it to register only those changes in response greater or less than a specified magnitude.[4] See *adaptive thresholding, resolution threshold*.
thresholding: Digital data processing technique that reduces a gray level image into a binary image.
throat, actual: Shortest distance from the root of a fillet weld to its face, as opposed to theoretical throat or weld size.

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