

INDUSTRIAL X-RAY CONVENTIONAL TO DIGITAL



BRIGHTON TRU-EDGE HEADS

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Industrial x-ray inspection is following the path of conventional photography and the medical x-ray field

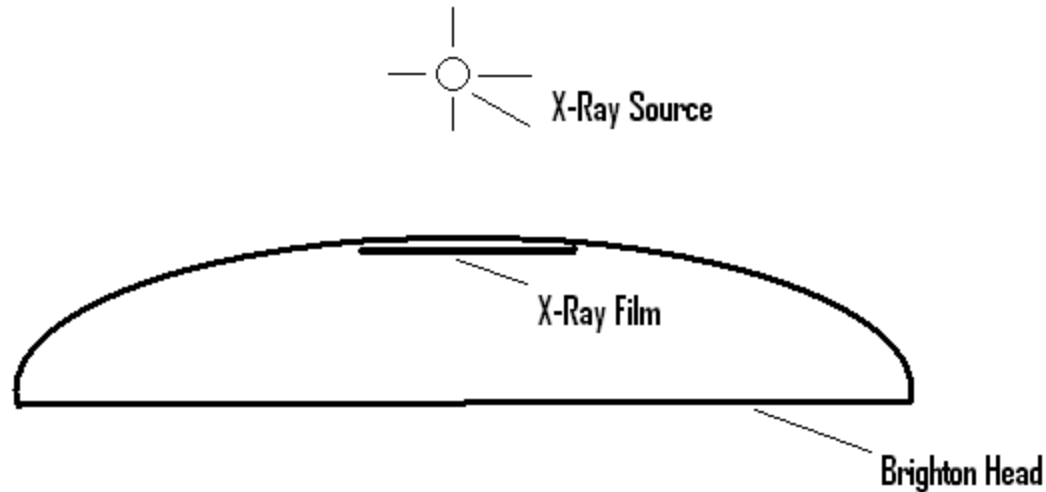
Film type photography and film for the medical field has been replaced with digital imaging

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Conventional Spot Tube 300KV X-Ray System mounted on a 4 axis gantry apparatus to permit positioning of the tube



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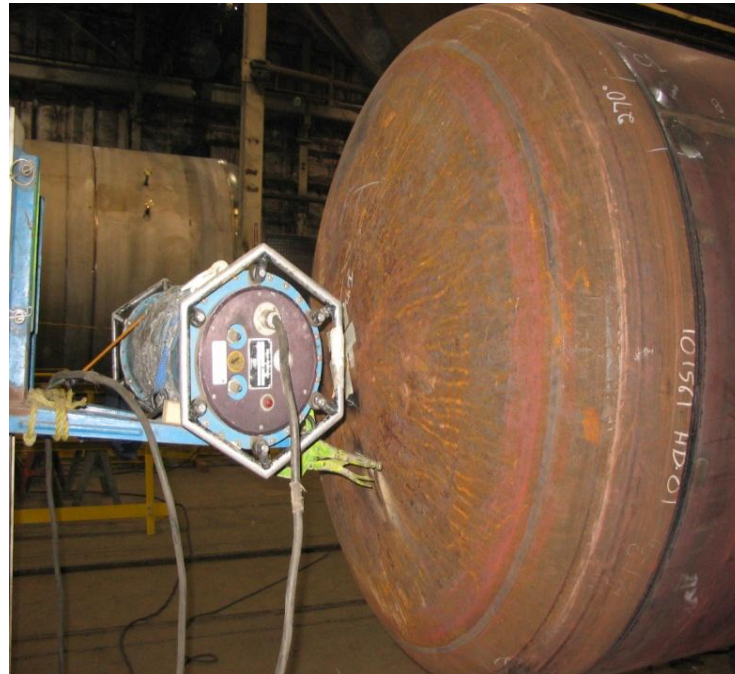
Film radiography is fading away. Digital imaging using computed radiography with reusable phosphor screens and CMOS detectors are replacing x-ray film

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Conventional x-ray set up for a 360 degree panoramic exposure with tube centered in the circumferential weld so entire weld can be x-rayed in one exposure

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Conventional set up for a center plug weld in a Brighton Head using a 250KV spot tube and x-ray film

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Conventional Radiography Using Film

Exposure is set up and taken with the exposure device on one side of the specimen and x-ray film on the opposite. Radiation is generated by applying current to an x-ray tube resulting in the generation of penetrating x-rays that are directed toward the subject or specimen.

Some of the radiation that is generated penetrates the object and exposes the film on the opposite side.

Exposed x-ray film is then processed in a film processor or by hand in tanks containing chemicals such as acetic acid and sulfuric acid mixes.

Processed film is then evaluation to agreed upon standards or specifications.

Processed film, in most cases is stored for a predetermined time, in some cases for the expected design or service life of the equipment or assembly it represents.

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Digital radiography uses CR plates or a detector in place of film. The generation of an image still requires the x-ray source to be positioned on one side of a specimen and the detector or the plate on the opposite. The source of radiation is the same as used for film radiography with one distinct exception. A suitable image is generated using considerably less radiation for shorter exposure times.

Image processing is simpler and in the case of a CMOS system is available “real time”.

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Computed Radiography (CR)

Computed Radiography is very similar to conventional radiography except a phosphor screen is used in place of film.

No chemicals are used or required for CR. The latitude of the image is considerably greater than film.

CR processors are desk top size and suitable for an office type environment.

Image storage and retrieval is accomplished using a mainframe backup or an external storage.

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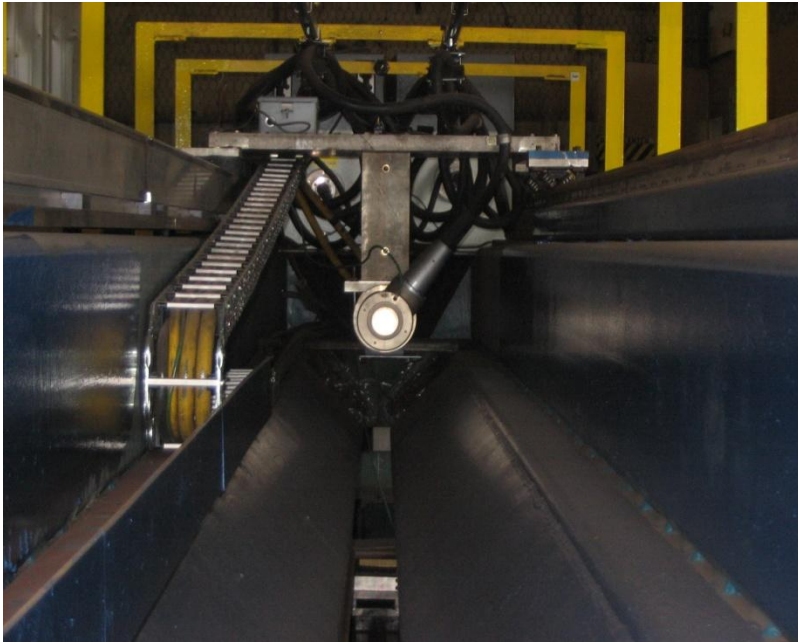
Complementary Metal Oxide Semiconductor, (CMOS) Detectors

CMOS Radiography uses a detector that converts a signal directly to a digital image. Technology was developed by NASA and adapted for use in radiography. Originally in medical and now for our industry.

There is no plate or film to capture the image. The detector is synchronized with the x-ray field and exposed . Image appears real time on a high resolution flat screen viewer.

Since image does not have to be processed, no chemicals or processor are required.

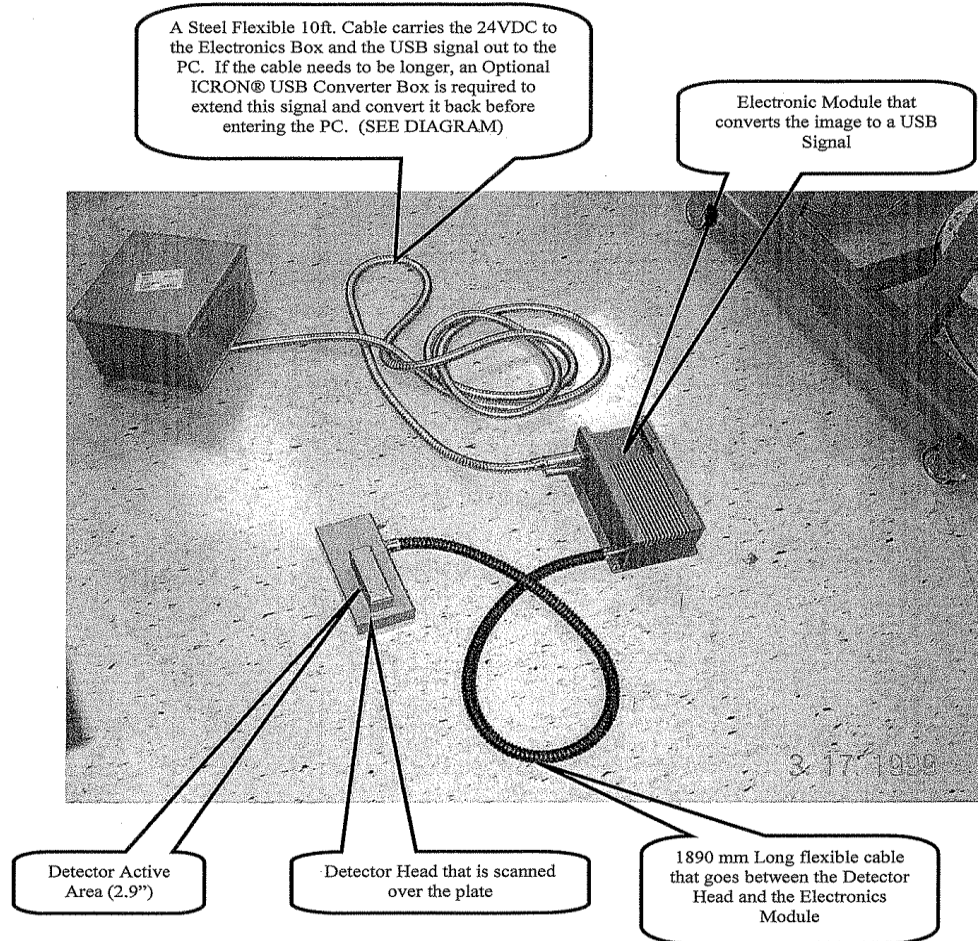
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Digital CMOS System for Plate Inspections

System equipped with a 300KV Comet Tube head and a Freshex, CMOS Detector Drive system, manipulation, Laser line up device all designed and built by Brighton Tru-Edge

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CMOS Detector, 2.9" wide

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Head is positioned in the positioner and the weld precisely lined up using a fan laser.

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Code Acceptance

ASME Code Section V Appendix II now contains the rules for real time radioscopic examination.

Appendix III covers digital image acquisition, display and storage for radiography and radioscopy.

Procedures need to be revised to encompass the ASME Code requirements.

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DICONDE STANDARD

Digital Imaging and Communications in Non-Destructive Evaluation (DICONDE) is the standard developed by the Federal Government that governs the loss of data and preservation of images.

ASTM E2339 is the Standard Practice for Digital Imaging and Communication In Nondestructive Evaluation.

The software system for digital imaging, storage and retrieval should be DICONDE compliant. Currently only mandated for Government contractors.

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Ultrasonic Inspection Method

Volumetric Inspection of welds considers Ultrasonic Inspection as equivalent to x-ray inspection. ASME Code Case 2235-9 describes the requirements for ultrasonic examination in lieu of radiography for material thickness $\frac{1}{2}$ " or greater may be examined using automated ultrasonics. This may be helpful for shops that process heavy plate weldments. Ultrasonics have none of the hazards associated with radiography such as radiation, chemicals, precious metal etc., so it is suitable for use on the Shop floor during normal production.

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The radiation hazard is still present with digital, however the quantity of radiation necessary to generate an acceptable image is reduced.

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Advantages of Digital X-Ray Over Conventional Film type Radiography

1. No x-ray film is required resulting in savings by eliminating film cost.
2. Hazardous chemicals for film developing are eliminated.
3. Dark room is no longer required.
4. Film processor or film processing tanks are eliminated.
5. Film storage is eliminated.
6. Chemical disposal is eliminated.
7. Less radiation necessary for exposures plus shorter exposure time.
8. Time for film processing and handling is eliminated.
9. No re-shots due to film artifacts since film is not processed.
10. Instant results, minimal lag time between exposure and interpretation.
11. Inventory of film and chemicals is not required.

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Digital vs Conventional

Initial Cost, 80K to 115K depending on system and options.

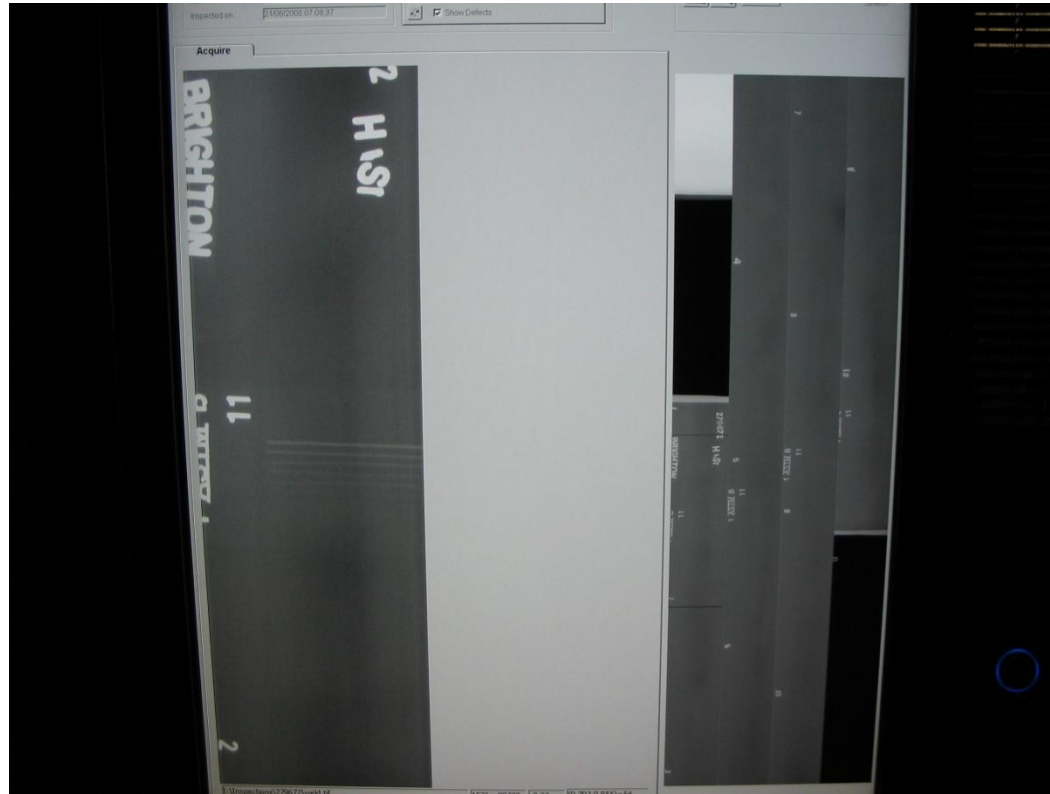
This is the only negative factor.

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Digital Justification

- Film cost
- Space requirements
- Processor cost
- Chemicals
- Increase in productivity i.e., x-ray inspection, fewer exposures since digital has considerably increased latitude vs. film, and image or film storage space.
- All of these factors need to be evaluated and amortized over a specified period 1 to 5 years, to estimate cost of digital vs. conventional film radiography.

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Actual digital image on flat screen monitor

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Software feature permits precise measurement of discontinuity for evaluation.

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Evaluation is immediate following completion of exposure

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Additional Factors to Consider

In process inspections: inspection of a thick weldment may be performed prior to welding opposite side.

Operations investigations: Pipe or valves may be x-rayed to evaluate position of valve seat or for product flow.

Insulation normally does not have to be disturbed when evaluating pipe or vessels in service.

Welds may be evaluated almost immediately after completion using CMOS method since film is not used.

Thickness capability of existing x-ray source is increased, less radiation is required to penetrate specimen to obtain an acceptable image.

After initial investment there is no film cost or processing chemicals to purchase or inventory.



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SAFETY

The amount of radiation necessary for an exposure is considerably less so the radiation hazard factor is less.

System may be designed for use on shop floor or in a cell with adequate shielding.

No hazardous chemicals to come in contact with.

No chemical disposal requirements since processing chemicals are not required.

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Film Availability and Cost

X-Ray film is going the same route as film used in cameras previously used for home and by professionals. It is being replaced with digital equipment.

Film manufacturers such as Kodak and Dupont have closed manufacturing facilities or stopped film manufacturing all together.

The cost of film will continue to increase as manufacturing stops.

The future is digital. The medical industry has already converted. Industry is converting now. I recommend budgets include allowances for evaluation of options and for conversion to digital starting this year.

Digital Photo Example



82# Halibut, Alaska 2010

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QUESTIONS ?????