

The NDT Technician A Quarterly Publication for the NDT Practitioner

NDT NDT

Focus The Radiographer's Eye

asically, radiography can be described as an examination that uses a beam of penetrating electromagnetic radiation to create the shadow image of a specimen's internal and external structure. Any examination that does not detect discontinuities is meaningless, misleading, and can create a false sense of security in a less than qualified product. Visualize the projected image. One of a radiographer's most important tools to ensure that effective NDT does happen is his "radiographers eye." To examine an item properly, the radiographer should have an understanding of the anomalies that could be present, and a grasp of the best way to display them. The radiographer must be able to visualize the item's projected image (shadow form) on a film or other recording medium. Shadow formation. If a group of people were to stand side by side in front of a wall and be illuminated by an auto's headlight, the projected image (shadow) of the individual most central to the beam would be true to his shape while the images of the other individuals would become more and more distorted as their distance from the center increased. If the same group of people were to stand in front of a curved wall whose radius matched the distance of the auto headlight to the wall, this would cause them all to "face" the beam in the same manner: all their projected images would then be true to shape.

This same condition of projection exists in radiographic examination and can be controlled and manipulated by the radiographer (Fig. 1). The beam of radiant energy that will cast the X-ray shadow image of the test objects comes from a very small focal spot and diverges as it gets farther from its source, much like the auto headlight's beam.

Proper Beam to Component Orientation.

Visualizing the proper beam to component orientation can mean the difference between imaging relevant indications or hiding them in the projected shadow of other component details.

- Volumetric (100 percent) inspection of castings is meaningless if the projected shadow of a large detail masks indications in thinner areas.
- Inspection of a fusion weld is meaningless if the part to beam orientation is such that lack of complete penetration or fusion cannot be imaged.
- Shrinkage in a casting radiographed from the wrong direction can appear to be a crack or hot tear. The definition of fine line



Figure 1. Diagram showing (a) proper and (b) improper beam to component orientation.

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A Publication of the American Society for Nondestructive Testing





he "Focus" article for this issue of *TNT* is adapted from a "Back to Basics" article previously published in ASNT's monthly journal *Materials Evaluation*. It talks about having an "eye" for the work process — in other words, successfully visualizing how the physics of the test must apply to the test setup. The test method discussed is radiography but the point, that understanding the process leads to improved test results, can be applied to all test methods.

The "FYI" series on ultrasonic testing is approaching an end and will be complete in the July issue of *TNT*. Preparation of the next series, dedicated to RT, is underway and will begin in our October issue. Look for an equally informative series written specifically for the technicians' perspective.

Our "Practitioner Profile" spotlights Jeff Garner and talks about the importance of finding a career "fit" and the good fortune that results when one has a mentor.

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indications such as cracks, hot tears, and incomplete penetration or fusion can be greatly affected if the beam is not orientated correctly to the fissure interface.

Specification Limits. Some specifications place specific limits on the extent of beam angle deviation from the normal plane. This is especially true for the examination of electron beam welds where little or no filler material is used and preweld fit-up is so tight that an exposure taken only a few degrees off parallel to the weld joint interface probably would not show lack of fusion even in an unwelded joint!

If a radiographer were to imagine the view from the radiation source, he would "see" the outcome of his radiographic setup. By visualizing the projection of the image of the item(s) being examined onto the recording medium, the radiographer can arrange the items to ensure the best possible image.

Proper Setup. A proper setup of parts should not look like an army of soldiers, all in straight lines and all facing the same way. This apparent neatness may look good when the setup is made but the resultant image of each of the parts will be different because of the projection caused by the small size of the radiation beam source and its divergence. Often all the items being examined must be aligned to "face" the beam in the same manner. The most important product should be the X-ray image and not the neat appearance or convenience of the straight line

setup.

Imaging Small Objects. A simple method for proper imaging of small objects when using film radiography is to curve the long dimension of the film to match the arc of the source to film distance (SFD) and then position the parts on the film. This small change (raising each end of the film 0.5 to 1 in. [12 to 25 mm] for a typical 48 to 60 in. [1.2 to 1.5 m] SFD) allows the beam to impinge upon all objects positioned on the central axis of the film at the same angle. The image of objects positioned away from the central axis of the film will still be affected by distortion — but not as much as if the film were laying flat.

Some parts, though small, might best be examined using only a single row of parts or even a single piece placed in the center of the beam and film.

Conclusion. Radiographic examination is more than a science, it is an art form that requires forethought and an ability to "see" the image of a specimen even before the exposure is taken. In a world where everything from cigars to storage tanks to space station components is being examined, convenience is important, economics is important, but using the proper setup to image all significant indications must always take precedence. **TNT**



FYI Practical Contact Ultrasonics — Defect Characterization and False Indications

by Jim Houf

his article describes common defects found in angle beam UT weld inspections along with examples of the transducer positions and resulting screen presentations related to those defects. Common false indications and the means of determining them are also discussed.

Using the Correct Terminology.

The following terms are often used interchangeably and sometimes incorrectly to describe ultrasonic testing signals.

Relevant and Nonrelevant Indications. A signal seen on the UT screen that results from sound reflecting from an internal reflector within the part being inspected or caused by a physical condition such as geometry is called an *indication*. A *relevant* indication is created by a physical reflector in the part. A *nonrelevant* indication is caused by part geometry or a physical condition other than an actual discontinuity or defect.

Discontinuity. A discontinuity is any foreign material in the part (slag, porosity, etc.) or an unintended disruption in the weld or base material such as a crack, incomplete penetration or incomplete fusion. If the discontinuity type and size are within the acceptable limits of the criteria of the governing documents, they may be acceptable. Small amounts of slag or porosity may be acceptable depending on their size. However, certain discontinuity types (cracks, incomplete penetration or lack of fusion) are often rejectable regardless of size.

Defect. A discontinuity that is rejectable is a *defect.* To determine that a discontinuity is indeed a defect according to the criteria of the governing code or specification, the UT operator must first know the type of discontinuity causing the indication, accurately locate it with respect to a known reference point on the weld, and determine its size.

Cracks

Cracks are usually linear and irregular or jagged. In normal indications, the damping in

the transducer causes the right side of the signal to drop off quickly. However, because a crack is jagged, multiple returns result, causing the screen signal to be much wider thus producing a distinctive indication on the UT screen referred to as a "church steeple" (Fig. 1).





Another effective way to determine that an indication is a crack is in the way in which a crack indication "walks" across the screen (Fig. 2). As the sound beam begins to move across the crack, the inherent beam spread causes the leading edge of the sound cone to reflect sound back well before the signal is maximized. This causes a short or low amplitude signal to appear on the far right side of the screen (signal A). As the transducer gets closer to the crack, more of the sound beam reflects back causing the signal height to increase and move toward the left side of the screen as the sound path gets shorter. When the centerline of the sound beam, where the sound strength is greatest, reaches the base of the crack, the signal is usually at maximum strength (signal B). As the centerline clears the crack and the trailing edge moves past the crack, the signal height drops and it moves toward the left of the screen until it disappears (signal C). In effect, we see a wide short signal that grows in height as it moves towards the left and then diminishes in height until it disappears.

If the width of the UT screen is set at one full skip distance, the crack should start to appear just to the right of the midpoint and then drop off the screen near the quarter point of the screen between the main bang and the midpoint (Fig. 2). If the crack starts from the scanning surface, the signal should walk in from the far right of the screen and drop off just to the right of the midpoint. These are generalizations and the exact location will depend on the material thickness and will vary due to the different sound paths. Because of this, it is possible for the operator to overlook a shallow same-side crack in the first leg if the signal is so close to the scanning surface that it appears to be part of the main bang.





Incomplete Penetration

An incomplete penetration (IP) signal tends to behave much like the signal for a crack, traveling from right to left on the screen; increasing and then decreasing in height. However, because IP is generally smooth-sided (the unfused edge of the weld groove) rather than jagged like a crack, the width of the screen signal is generally much narrower than that of a crack signal. A problem that occurs frequently is that since the IP is at the root of the weld, the screen signal may not have been fully maximized when the transducer hits the near edge of the weld crown. In thinner materials, this problem is likely to occur. Scanning from both sides of the weld may not catch this configuration. If the signal continues

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to increase in height until the transducer hits the weld crown, it may be that the signal, which has not reached rejectable size, is indeed rejectable. If this occurs, a smaller transducer may be needed to get close enough to fully maximize the signal. Failure to do so may cause an operator to accept a rejectable defect.

Sidewall Lack of Fusion

Sidewall lack of fusion (LOF) is a particularly hard defect to identify. Common bevel angles in weld joints do not often complement the angles used for ultrasonic testing. As a result, the orientation of the unfused sidewall of the weld may not return a signal amplitude large enough to be rejectable. Additionally, sidewall LOF may not show at all in the first leg when the weld is scanned from the side where the defect is located, or may show as an acceptable indication when seen in the second leg. Thus, the weld must be inspected from both sides when the part configuration permits. If signals occur that are determined to be along the side of the weld, even if they do appear acceptable, it may be necessary to switch wedge angles and interrogate the area again to determine whether or not sidewall LOF is present.

Slag

During the welding process, powdered or granular flux is melted to provide shielding gasses for the welding arc. As the residue cools, the solids form a glasslike substance called *slag* which may be trapped in the weld creating a slag inclusion. An overall irregular shape is a clue that a slag inclusion is the indication being seen.

Because the cone-shaped sound beam hits the irregularly shaped slag at several points at once, the signal tends to give a presentation with multiple peaks (Fig. 3). As the transducer moves forward, the centerline of the beam hits the various contours with more strength, causing the height or amplitude of each signal to increase and then drop off as the sound beam crosses each reflection point. As a result, the multiple peaks of the signal will go up and down as well as move slightly to the right or left as the scan progresses. This signal with multiple peaks alternating up and down is typical of slag inclusions. The alternating peaks can be effectively demonstrated by stopping the transducer when a multipeak signal is maximized then angulating the transducer back and forth sideways at that position.

Porosity

Weld *porosity* forms in a manner similar to slag, when gas is trapped in the cooling weld metal before it can escape to the surface of the





Figure 3. The cone-shaped beam (a) hits irregularly shaped slag at several points simultaneously and results in (b) a typical slag indication with multiple peaks.

weld. However, rather than having solids in the inclusion and being irregularly shaped, pores are usually gas-filled and rounded in shape. **Reflectors.** A flat (planar) surface perpendicular to the sound beam will reflect a large amount of sound resulting in a very high screen signal. A side-drilled hole is a line reflector, reflecting sound from the circumference only where the sound beam strikes the hole perpendicular to the circumference with a length equal to the depth of the hole. As a result, the signal from a sidedrilled hole is smaller in screen amplitude (height) than a planar reflector.

A rounded reflector, such as a gas pore, is a point source and sound only reflects from it at a single point where the sound beam strikes the hole perpendicular to the circumference. Because a pore has no appreciable length and the diameter is usually a very small percentage of the cross-sectional area of the sound beam, the signal from a pore returns a very small amount of sound, resulting in a very discrete screen signal often of low amplitude. The effect of the sound beam reflecting from that circular shape gives the screen signal for porosities distinctive characteristics.

When the sound beam first hits a circular pore, it does so at a slight angle, causing the sound to reflect away from the transducer (Fig. 4a). As the centerline of the sound beam hits the pore directly, sound is reflected back to the transducer (Fig. 4b). However, as the centerline passes over the pore, sound in the lower portion of the sound cone is again reflected away from the transducer (Fig. 4c). The overall result is a single, narrow, sharp signal that pops up on the screen at only one location and then disappears immediately. There are some exceptions to this; if the pore is large or is close to the scanning surface, the signal may move slightly to the left, usually 1 to 2 minor graticules, before disappearing.



Figure 4. Position of sound beam relative to gas pore with resulting screen indications as (a) leading edge, (b) centerline, and (c) trailing edge of sound beam strike pore.

Again, the pore is a point source and once the signal is maximized, the operator will notice that a slight movement of the transducer forward or backward, or oscillation of the transducer slightly to the right or left, will cause the signal to disappear.

In the case of cluster porosity or closely aligned pores, the screen display may demonstrate several signals very close together that can be confused with a slag inclusion. However, it is often possible to isolate the individual signals, which will show the very tight or narrow trace and the location of each signal at one spot without significant lateral movement, which generally does not occur with a slag inclusion.

Nonrelevant and False Indications

As mentioned earlier, nonrelevant indications are those that will not affect the use of the part or are created by geometry or other physical characteristics. Some of the more common indications in this category are backing bar indications, mode conversion and signals from sources outside of the weld. Backing Bars. Backing bars are commonly used in butt welds on structural steel. Their purpose is to provide a surface under the weld groove on which to lay the first bead or root pass of the weld. A properly welded backed butt joint will result in full penetration between the sidewalls of the weld and the backing bar. As a result, sound may enter the backing bar through this weld junction, ricochet around in the backing bar, reflect from one of the corners and then return back to the transducer. Figure 5a shows this joint configuration and how the sound beam may reflect back from a corner. The signal from the backing bar reflector shown will appear just a bit into the second leg and may be misidentified as a sidewall discontinuity because of the apparent location of the signal on the screen (Fig. 5b). If the backing bar is accessible, this type of false indication can usually be damped with a finger wet with couplant as shown.

Mode Conversion. Mode conversion results when a shear wave reflects from a surface that causes the wave to convert to a longitudinal wave. This occurs occasionally on backed welds when the shear wave hits the gap created by a poorly fit up backing bar, converts to a longitudinal wave and travels up to the weld crown (Fig. 6). The L-wave then returns to the root, converts back to a shear wave and returns to the transducer. Because the L-wave velocity is approximately twice that of a shear wave, the resulting signal appears about halfway out in the second leg. The weld crown is a good reflector and the signal is very strong, often exceeding 100 percent of full screen height.

The location and height of the mode conversion signal easily identify this type of









Figure 6. Illustration of (a) mode conversion that results when a shear wave reaches the gap caused by a poorly fit up backing bar with (b) the resulting signal.

false indication. First, the height of the signal is extremely strong for a discontinuity at the apparent location. Secondly, if the sound path is calculated correctly, the operator can see that the apparent location is outside of the weld and heat-affected zone. When this occurs, damping the surface of the weld with a wet finger shows that the sound has converted and can be damped on the weld crown. Mode conversion like this can also occur in open root pipe welds and double V plate welds if the root or opposite side weld crowns are a shape that permit it.

Extraneous Reflectors

Occasionally, screen signals show up where no signal should logically be. An example can be shown in beam-column connections. If a gusset plate has been welded between the column flanges to carry the structural load across the column and the plate is in line with the upper and lower beam flanges, the gusset fillet welds may reflect sound back to the transducer as shown in transducer positions A and B in Fig. 7. These signals can be confusing because they appear to be outside the weld area. When these occur, it is necessary to visually inspect the part to see if another part or weld may be causing the errant signal.



Figure 7. Beam column connections can be the source of extraneous reflectors as in A and B and nonrelevant indications as in transducer location C.

Another nonrelevant indication may occur in beam-column connections if cope holes have been cut in the web to permit access to the full width of the beam flange. This signal usually appears strong in the first leg when the transducer is near the center of the beam (over the web) but is too far away from the weld to be a relevant indication as in transducer position C in Fig. 7. If this occurs, the operator should wet a finger with couplant and damp along the edges of the cope hole to confirm that the signal is coming from the hole.

It should be noted that the discontinuity descriptions discussed in this article are general in nature and the actual discontinuities in production welds may vary depending on wedge angle, material thickness, weld configuration and discontinuity size. However, if operators are familiar with the general screen presentations for different discontinuity types, they are better equipped to categorize a weld defect or correctly identify false indications that would be costly if misidentified and called out as defects. **TNT**

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Feature Job Safety — Using Ladders Correctly

by William W. Briody

he simple portable ladder is the most common method used by inspectors or NDT technicians to access test areas. Widely used, both at home and at work, ladders can make work easier and faster when used correctly. However, they can be dangerous tools if safety rules are ignored. Falls involving ladders are the second most common type of injury with more than 30,000 people injured nationally each year. Following these easy steps each time a ladder is used can prevent unnecessary injuries.

Selecting the Correct Ladder

First, look at how and where the portable ladder is to be used:

- When working away from sources of electricity, wood, aluminum or fiberglass ladders may be acceptable.
- When working around energized electrical conductors, a ladder made of a nonconductive material such as wood or fiberglass is generally required. Wooden ladders are not typically used out-of-doors because exposure to the elements decreases their usefulness. They are also substantially heavier than other materials. Fiberglass is lighter than wood though not as light as aluminum and is quite durable. When clean and dry, it is nonconductive and the best choice if you must work around electricity.
- Choose the ladder best suited for your purpose. Some ladders are better than others for reaching high places; others allow for more horizontal reach.
- Look at the load rating of the ladder. Higher load ratings indicate a sturdier ladder, but usually entail more ladder weight
- Consider how many times you will have to go up and come down the ladder, as well as the range of heights that must be reached and the type of equipment needed when you are at the working level.
- The height of the ladder is very important since the technician may need to access more than one surface of the section to be tested.
- If added stability at the upper portion of the ladder is necessary, consider attaching a stabilizer that rests against and below the top of the vertical support.

Carrying Ladders

When carrying ladders, follow these steps to avoid damage to the ladder and to prevent unnecessary accidents:

- It is best to have two people carry a ladder. If this isn't possible, a single carrier should be as close to the center as possible.
- Less effort will be exerted if the ladder is carried horizontally with the front tipped slightly higher than the back. This also reduces the chance of dropping the ladder.
- When making blind turns, announce your presence to ensure that you don't strike another approaching person.
- Do not drop or otherwise abuse ladders.
 Rough treatment can weaken ladder parts and lead to future failure.

Inspecting Ladders

Determine that the ladder is in good condition before use by inspecting it carefully for damage. On wooden ladders, check for cracked rungs or rails. Rungs must be spaced no less than 10 in. apart nor more than 12 in. apart. On aluminum or fiberglass ladders, check for broken welds at the rungs and other defects. Defective ladders should be removed from service. Pay close attention to ladders furnished by other contractors or trades on temporary job sites.

Positioning Ladders

Improper ladder set-up is the most common cause of accidents. Follow these basic rules for safe set-up:

- Place the ladder only on a level and solid surface, using skid plates or stabilizers as necessary.
- Do not use the ladder on slippery surfaces without slip-resistant feet and do not depend entirely upon these feet to substitute for holding the ladder in place.
- Check for overhead obstructions or lines that can interfere with the set-up.
- Ladders placed in any location where they may be accidentally displaced must be secured and visibly marked to alert other workers and traffic in the area.

- Doors located under the ladder that open toward the work area should be locked and posted.
- Place the ladder at the proper angle by using the 4 to 1 rule. This rule specifies that the base of the ladder should be placed one foot away from the vertical surface for every four feet of ladder height. For example, the legs of a 28 ft. ladder should be placed 7 ft. from the base of the working surface.
- The top of the ladder should extend at least three feet beyond the top of the vertical surface, but the extension must not be so excessive that it causes the ladder to slip at the bottom.
- The ladder should be tied off as close to the top as possible, utilizing the assistance of another person to hold the ladder while this is accomplished.

Ascending and Descending Ladders

Observe these rules when ascending or descending a ladder:

- Before ascending, do as much prep work as possible on the ground.
- Do not hand carry tools or equipment up the ladder. Use a tool belt or hand line.
- Always face the ladder when climbing up or down, keeping the base of your body aligned between the rails.
- Do not use the back side of the ladder for climbing.
- Always keep at least one hand on the ladder or use a safety harness while working.
- Never over reach. It is safer to descend and move the ladder as necessary.
- Never try to shift or move a ladder while you are on it.
- Do not use the top two rungs of the ladder.
- Allow only one person at a time on the ladder.
- Do not slide down the rails of the ladder.

Storage

When finished with the ladder, store it properly to control warping, sagging or weather damage. Straight ladders are best stored flat or on wall brackets. Step ladders are to be stored vertically in a closed position. **TNT**

OSHA regulates the adequacy of ladders and the work practices followed by employees using them in four sections:

- Portable Wood (1910.25),
- Portable Metal (1910.26),
- Fixed Ladders (1910.27) and

Ladders used in Construction Industry (1926.1053) These sections specify the standards to which portable ladders must be manufactured, care and placement of ladders in the workplace, and safe use of ladders on the job.

Bill Briody is a Lifetime member of ASNT. He is currently Chair of the Section Operations Council Membership Division and a member of the *TNT* Technicians Advisory Committee. (804) 264-2701, <bbriody@fandr.com>

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PRACTITIONER PROFILE Jeffrey L. Garner

Jeff Garner has found his "career fit" and has also had the good fortune to have found a mentor. In addition to the opportunities to acquire skills, methods and work habits that would otherwise come only with years of experience, a mentor can provide a source of advice and encouragement in a protected learning environment as well as invaluable contacts and resources that the mentor has developed over the years. There are benefits for the mentor too. There's the satisfaction of passing along the professional experience accrued over a career, and if all goes well, the mentor's workload may be appreciably reduced.

Q: How did you first become involved in NDT?

A: I went to the College of Oceaneering to become a commercial diver and learned NDT there. I had been a helicopter mechanic in the Army for six years. I continued that for a couple more years after leaving the Army but the aerospace industry was not very stable. I learned about the College of Oceaneering in a skin diver magazine. The day I found out that I was going to be out of work, I went home and the magazine had come that day in the mail. It opened right to that page and I decided I would give it a try. Half of



the classes were for diving. For the other half, you chose a specialty — inspection, welding or medic. I chose inspection and took Level I and II classes for UT, MT, PT and VT. Basically, this gives you another career option to fall back on if you don't stay in the diving industry. Only a very small percentage of the people that go to commercial diving school stay in it. It sounds glamorous but it's hard, and dangerous work

and you're offshore all the time, away from your family. I finished the year and went to work for a dive company in the Gulf of Mexico for six months. I figured out that wasn't going to be my thing and I called a friend of mine that was working for my current employer, IESCO. He suggested I apply. So I came home, interviewed, got the job and I've been doing NDT for about ten years now.

Q: What kind of structures are you examining?

A: I work mostly in chemical plants and oil refineries, pressure vessels, piping systems using automated UT. I'm collecting the data on a computer from an automated or motorized scanner.

The scanner has magnetic wheels that stick to the vessel or piping which allow it to crawl along the structure. The computer maintains a permanent record of the inspection. Much like the radiograph in X-ray.

Q: Can automated testing be used in all situations?

A: Well, there's certainly limitations to it — like anything. Most stuff in an oil refinery you can do automated but it's really case by case whether you can or not.

Q: Describe a typical workday.

A: I normally go to a refinery and meet with the inspector. It's usually me and one other person. The refinery inspector will tell us what the work scope is and we basically take it from there. We go and get all our permits and set up and do what we need to do. We're pretty much self sustaining from there.

Q: How specific are the instructions from the refinery inspector?

A: Most often, you run into one of two situations. They may be specific and tell you, "Okay, we have these welds to inspect; we're expecting this kind of damage. We'd like you to do time-of-flight." Or, they may simply ask for a recommendation of what I think would be best.

Q: How is time-of-flight defined?

A: TOFD, time-of-flight diffraction is an advanced UT technique using a computer. It can be automated or done with a manual, encoded scanner. It's excellent for the sizing of cracks. Two transducers set up in a "pitch catch" mode read diffracted energy rather than reflected energy. Diffracted energy is like in the ocean, where you have rock jetties sticking out into the water. Waves come in and hit the jetty and then echo off the tip of it. TOFD is the same sort of thing; the transmitting beam hits the crack and the crack rings and then the other transducer picks up that ring.

Q: Are most of the structures you test under pressure?

A: Well, they can be under pressure or they can be out of service. They're all pressure vessels, reactors.

Q: What types of indications are you looking for?

A: Cracking — hydrogen induced cracking and high temperature hydrogen attack. When hydrogen is in an atmosphere of high temperature and high pressure, it goes into solution, penetrates the metal and gets caught in the grain boundaries or discontinuities of the metal where it starts to fissure. Fissuring is basically a series of really tiny cracks. We're also looking for corrosion or thinning of the plate material.

Q: What other NDT methods do you use?

A: I use MT and PT as well but mainly I use advanced UT — automated UT, time of flight diffraction to detect high temperature hydrogen attack.

Q: Do you travel in your work?

A: Yes, all over the US and the world really. It's interesting but a little hard on family. Trips are normally quick — like a week. I've worked in Trinidad, Aruba, Puerto Rico, throughout Canada, Newfoundland, and all over the US. Almost all has been in chemical plants and refineries.

Q: What other types of NDT training have you taken?

A: ACFM or alternating current field measurement. It's a variation, or similar to, surface eddy current. I'm also in the process of getting ASNT Level III certification in UT. Most of my training is by or is arranged by my employer. All inhouse training is now done by Ron Nisbet. Ron has been my mentor and I think highly of him. Having a mentor is really important. I

call him whenever I have a question or need a second opinion. He's easy to talk to, knows about a lot of things and is willing to share his knowledge.

Q: What's the worst part of NDT?

A: For me, the most difficult thing is being away from my family.

Q: What's the best part?

A: There's always more to learn. You can take a lot of different career options and routes. For instance, the more specialized and advanced NDT techniques.

Q: In your opinion, what are the growth areas in NDT?

A: Ultrasonic testing is a growth area. UT equipment is getting better and there are efforts to improve the training and education of the people doing the work.

Q: What advice do you offer those considering careers in NDT?

A: I just stress a strong work ethic. You can go as far as you want. It's up to you to put in the effort to get the training and find the opportunities you need. You have to actively seek it out. **TNT**



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U.S. Patent # 5.959,30



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- Q. I understand that NAS 410 now requires Level II inspectors to recertify every five years. Why is my Level III requiring me to recertify after three years? J.H., Cleveland, Ohio
- A. Your company's written practice may require three year recertification intervals, possibly to meet the recommended maximum recertification period for Level IIs per SNT-TC-1A. Also, many customers still require recertification intervals to be every three years.
- Q. What is a "penetrameter verification" shot in radiography of a weld? T.B., Mobile, Alabama
- A. When part configuration will not allow penetrameter placement in the area of interest or an adjacent area, a penetrameter is placed directly on the weld and a radiograph is produced. The penetrameter is removed and another radiograph is made of the same area. This is only allowed when documented by an approved technique.

Q. In the past, I always measured white light intensity in footcandles (ftc). Then, I had to measure in lux (lx). I now am being asked to measure in footlamberts (fL) as well. What is the difference and why do I have to do this? M.M., Phoenix, Arizona

A. Footcandle and lux are illuminance measurements (photometric flux per unit area) typically taken using a cosine corrector or a detector with a broad field of view. Illuminance varies in inverse proportion to the square of the distance. Footlambert and candela per square meter (cd/m²) are luminance measurements (flux density per solid angle) typically taken with a small aperture or small viewing area. Luminance measurements are independent of distance as the sampled area increases with distance. Units used vary according to customer requirements.

- Q. Is hardness testing considered NDT? G.M., Victoria, Australia
- A. Hardness testing is usually considered complementary to NDT because hardness tests are used to determine a different set of conditions than are detected by NDT. Typical hardness tests alter the region being tested by plastic deformation. It is not commonly classified as a nondestructive test.

TNT reader responds to query in January issue.

In the January 2005 issue of TNT, there was a question from E.H of Burbank, CA about redness of the hands after working in MT. Having been around and working in MT for the last 30 years I've found that carbolated salve works very well in clearing up the redness and the rashes that sometimes occur when one is in contact with MT carriers for an extended period of time. Hope this is of help. T.D., Indianapolis, Indiana

E-mail, fax or phone questions for Inbox to the Editor: <hhumphries@asnt.org>, phone (800) 222-2768 X206, fax (614) 274-6899.

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The NDT Technician

A Quarterly Publication for the NDT Practitioner

Volume 4, Number 2

April 2005

Publisher: Wayne Holliday Publications Manager: Paul McIntire

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The NDT Technician: A Quarterly Publication for the NDT Practitioner (ISSN 1537-5919) is published quarterly by the American Society for Nondestructive Testing, Inc. The TNT mission is to provide information valuable to NDT practitioners and a platform for discussion of issues relevant to their profession.



ASNT exists to create a safer world by promoting the profession and technologies of nondestructive testing.

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