SCARFING TUBE AND PIPE—CUT TO THE QUICK

PART III: DRAWING A BEAD ON IMPROVING ID SCARF REMOVAL AND DISPOSAL

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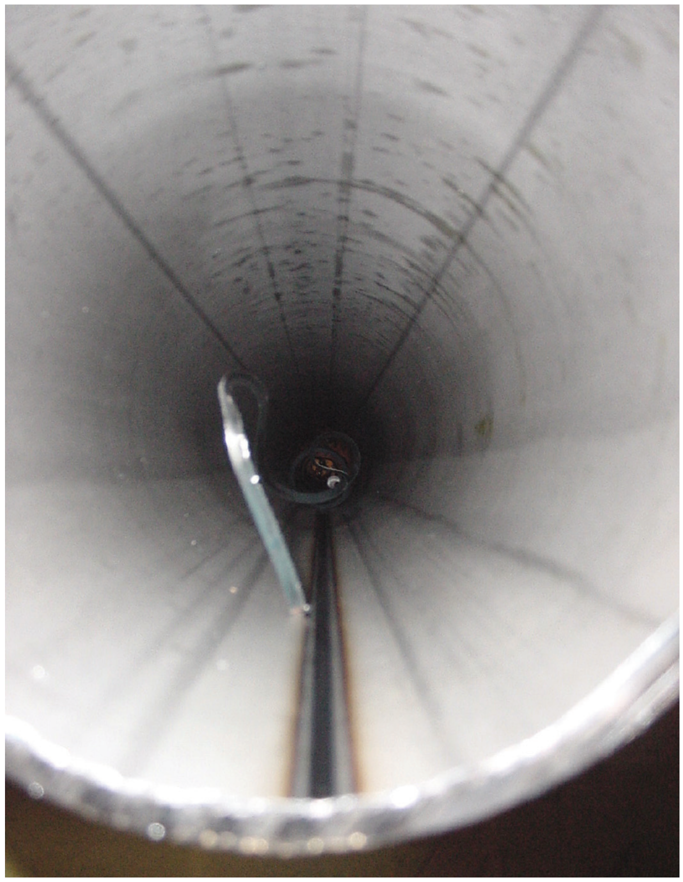
Editor's Note: This is the third article in a three-part series on cutting, removing, and disposing of weld beads. Part I, which appeared in the July/August issue, discussed the reasons to remove the weld bead and equipment parameters that affect the scarfing process. Part II, which appeared in the September issue, discussed manual and automated removal processes. Part III discusses strategies for improving ID weld bead removal and disposal.

THE biggest mistake made in ID scarf blowout operations is oversizing the blowout portion in an attempt to remove 100 percent of the ID scarf scrap. This isn't meant to imply that 100 percent ID scarf removal isn't desirable, but that oversizing the blowout is based on a misconception. The culprit in this scenario is an attempt to compensate for deficiencies elsewhere. When the weld seam and the ID bead scarf mandrel are not in line with each other—when either of them moves away from the normal (12 o'clock) position—the scarfing process does not cut the weld bead from the tube wall completely.

When the cutoff process has welded the ID bead to the pipe end inadvertently, no amount of compressed air or water can remove it. You might get lucky and break the strand free from the tube wall or tube end, but the tube is still a candidate for rejection. Remember, it takes just one unscarfed section hanging onto an inside bending mandrel to cause a customer to reject a truckload of pipe. The bottom line is the ID scarf scrap must be free to exit the tube for the blowout process to be successful.

An off-center weld bead results in a strand that remains attached to the tube, whereas a typical strand produces a "bird's nest" (see **Figure 1**). If you were to push a long pole into the tube, the bird's nest would slide out easily after you overcome the frictional bite. A well-designed blowout system overcomes the bird's-nest condition, not the off-center scarf condition.



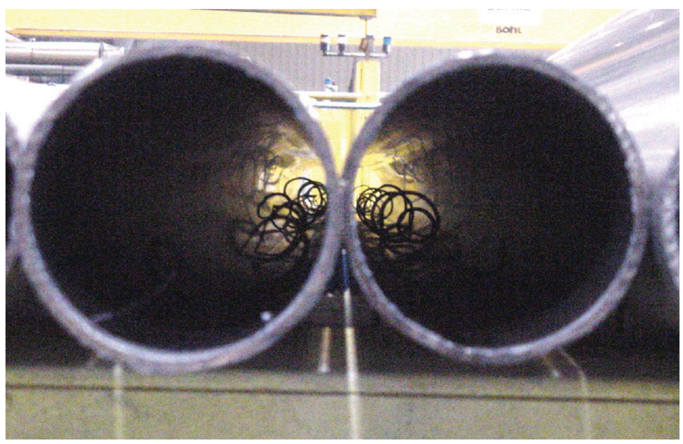


Figure 1
The strand in the top photo did not get cut completely from the tube wall. Removing this strand of scarf with compressed air or water is difficult. The tangled scarf strand in the bottom photo, called a bird's nest, is a typical strand. Blowout systems are designed to deal with bird's nests, not strands that cling to the tube wall.

GUIDELINES FOR SUCCESSFUL ID BLOWOUT

Oversizing the volume of air or water used in each blowout cycle consumes extra energy, increases noise, and increases maintenance requirements. To minimize these effects, consider these tips:

• Direct the energy from the blowout process at the tube or pipe centerline. The tube's position as it cycles past the blowout nozzle must be on target each time for the most effective operation.

• The most efficient blowout uses the lowest pressure and the highest momentary flow. You want to create a momentary impulse, or push, to break the scarf free and then move it out of the tube. Base the impulse energy on tube length with the flow nearing tailout as it exits the tube.

• Time is required to accomplish good blowout action. Process multiple tubes to gain additional cycle time and make the process more reliable.

• Don't attempt to create a fire hose. The water must go somewhere, and using vast quantities of water creates yet another handling problem. High-pressure flow can actually bounce off surfaces and make the job of draining the discharge harder. Your goal is to blow the ID scrap no farther than just a little past the far end of the tube. A high-pressure, high-volume flow also creates more misting and water vapor problems inside the plant.

• Remember what you are really attempting to move. For a mill that processes 3-inch-OD tube with a maximum wall thickness of 0.165 in., the ID bead scrap has a mass of 1 to 2 pounds. Although the scrap has a friction grip on the tube ID, if it isn't attached it will slide out after it is bumped free. Consider that a slug of water (1.5 gallons) weighs about 12.5 lbs. If it leaves the blowout at a velocity sufficient to travel a tube length (20 feet) in five seconds, how much kinetic energy does it have? Velocity in feet per second equals the distance traveled (20 feet) multiplied by 60 seconds divided by the time of flight (5 seconds); $(20 \times 60)/5 = 240$ feet per second. Kinetic energy = W (mass) multiplied by velocity^2/2 x gravity = $(12.5 \times 240^2)/(2 \times 32.16) = 11{,}195$ pound-feet. If that doesn't move the 1- to 2-pound ID scarf ball, nothing will.

• Base water blowout on a fill factor. Square the tube's ID and multiply by pi to compensate for multiple helical contact lines. Multiply this result by 10 for a preliminary estimate of the slug size needed to break loose and move an ID scrap bird's nest. The calculated mass in cubic inches divided by 231 returns an answer in gallons per cycle (a gallon contains 231 cubic inches). For a 3-in.-ID tube, this slug is $(3 \times 3 \times 3.14 \times 10)/231 = 1.22$ gallons per cycle. This 1.22-gallon charge creates an impulse force of 9,131 pound-feet when traveling at 240 FPS. The pressure required to create a force of 240 FPS when using a 1-in.-ID hose nozzle is $P = (V/12.1)^2 = (240/12.1)^2 = 393$ pounds per square inch.

CHOP SCRAP

Scrap choppers can reduce the volume of the ID bead scrap, which reduces handling. The design of the scrap-processing portion of the installation must take into account both the velocity and the volume of the scrap ball anticipated. In other words, the system must chop the scrap while the water or air used to move the scrap passes through it. An alternative strategy is to divert or slow the water or air so it does not interfere with the chopping. The path into the scrap chopper must be free of abrupt shoulders or reductions so the blowout mass has a direct path into the machine.

Ready-made, drop-in chopping systems do not exist. Because each tube or pipe mill is unique, ID chopping installations are tailor-made for each mill. No two mills produce the same tube diameters or lengths, or weld at the same speed, so no two scarf choppers handle the identical volumes of scrap.

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