

The information and data contained in this document were prepared by a technical committee of the Association. The committee and the Association assume no liability or responsibility in connection with the use of such information or data, including but not limited to any liability under patent, copyright, or trade secret laws. The user is responsible for determining that this document is the most recent edition published.

Liquid penetrant testing of new suction roll shells

Scope

This Technical Information Paper (TIP) covers liquid penetrant testing of new suction roll shells produced for new or replacement equipment. This TIP is intended for centrifugally cast and rolled/welded shells. This procedure is applicable to both stainless steel and bronze shells.

It is recognized that no suction roll shell is perfect and shells can deteriorate under widely different applications and operating conditions. Therefore, the purpose of this TIP is to establish procedures for documenting the surface condition of the suction roll shell, as manufactured, so that the information may be compared with data gathered periodically after the shell is in service.

It is beyond the scope of this TIP to recommend criteria for rejection of new shells based on the size or quantity of flaws. However, manufacturers will usually have standards for acceptance/rejection of shells that they produce. Nevertheless, acceptance criteria should be as agreed upon by the purchaser and supplier.

Definitions

1. *Linear flaws*: cracks, laps, shuts, and tears which are generally observed as jagged and with the length exceeding five times the width.
2. *Rounded flaws*: inclusions, shrinkage and/or porosity, which appear to be rounded or elongated with the length of the major axis less than five times the width. Flaws may appear as jagged areas or irregular patches.
3. *Reportable flaws*: linear or rounded flaws which, by prior agreement between the purchaser and supplier, will be documented.

Safety precautions

Adequate ventilation is required when working with liquid penetrant and solvent materials. Extreme care should be exercised to ensure that the work area around the suction roll shell is well ventilated, particularly when working on the inside surfaces. Suitable precautions are likewise necessary when working with electric lighting or fans in and around the shell. Internal inspection involves confined space entry - appropriate procedures for confined space entry should be followed.

This TIP may require the use, disposal, or both, of chemicals which may present serious health hazards to humans. Procedures for the handling of such substances are set forth on Safety Data Sheets which must be developed by all manufacturers and importers of potentially hazardous chemicals and maintained by all distributors of potentially hazardous chemicals. Prior to implementing the procedures set forth in this TIP, the user should determine whether any of the chemicals to be used or disposed of are potentially hazardous and, if so, should follow

strictly the procedures specified by the manufacturer, as well as local, state, and federal authorities, for safe use and disposal of these chemicals.

Liquid penetrant testing

The test is normally performed after machining both the inside and outside diameter surfaces, but prior to drilling the shell. However, testing may be performed after drilling, especially if the purchaser desires a baseline report before the roll goes into service. For testing after drilling, refer also to TAPPI TIP 0402-19 "Guidelines for nondestructive examination of suction roll shells."

The test method normally used is ASTM E-165, Type II – visible, liquid penetrant inspection, Method A (water washable), or Method C (solvent-removable). An alternate method of ASTM E-165 that may be used is Type I – fluorescent, liquid penetrant inspection, Method A (water washable), or Method C (solvent-removable).

Caution - Low sulfur/halogen penetrant inspection materials are to be used, according to ASTM E-165.

Centrifugally cast shells are tested over 100% of the shell surface, both inside and outside.

Rolled and welded shells may be tested over 100% of the surface, but it should be adequate to test only the circumferential and axial welds, inside and outside. The welds should be clearly visible in the right light after turning the blank shell. Testing is performed on an 8-inch band, centered on the weld. A benefit of the reporting method shown in the Appendix is that the welds are referenced to the serial number stamped on the end of the shell, which will serve as a map to locate the welds for later, in-service inspection. (While not within the scope of this TIP, it should be noted that the weld joints in welded suction roll shells should be examined with either the radiographic testing (RT) or ultrasonic test (UT) method to ensure the welds are full penetration with no defects that could affect the integrity.)

Evaluation and disposition of flaws

It is recognized that interpretation and evaluation of flaws in suction roll shells is a difficult task, dependent on many variables. Therefore, any acceptance criteria must be based on the specific shell in question. Flaws are acceptable to the extent agreed upon by the purchaser and supplier. In general, such flaws should not be injurious to the performance of the suction roll. As noted above, manufacturers usually have standard criteria for acceptance/rejection which may be available to the purchaser. Acceptance/rejection criteria between the purchaser and the supplier should be agreed upon prior to confirmation of the order.

The actual size and shape of reportable flaws should be determined by visual and/or microscopic examination after the developer is removed. It may be necessary to remove smeared metal by abrasive sanding or acid etching.

Caution - If acid is used, the precautions noted in Appendix A1.1.1.8 of ASTM E-165 shall be exercised.

Reporting

The results of the penetrant inspection should be graphically plotted to scale so that flaws can be again located during an in-service inspection. Graphs should be prepared for both the inside and outside surfaces. The graphs should note the serial number of the shell and the location of surface flaws with respect to the serial number. The location of welds should also be identified with respect to the serial number (longitudinal welds), and by the distance from the end marked with the serial number (circumferential welds). Photographs of flaws may be produced (with a scale) to assist with documentation.

Only reportable flaws need to be recorded. The minimum dimensions for a reportable linear and rounded flaw should be stated on the report. If no reportable flaws are observed, the report should state the same.

A sample report form and example are included in the Appendix.

Keywords

Nondestructive tests, Penetrants, Quality control, Vacuum rolls