

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.

Weld repairs on new suction roll shells

Scope

This TIP covers considerations for weld repairing new suction roll shells. It has been shown that suction rolls fail in service due to a variety of causes, one of which may be a discontinuity that is produced when a new shell is weld repaired.

This TIP serves two functions: (1) to acquaint the industry with factors of weld repairs in suction roll shells that may influence the shell service life, and (2) to provide a means whereby repairs in individual shells may be documented and later compared with shell performance.

It is beyond the scope of this TIP to provide criteria for rejection of new shells based on the size or quantity of flaws. Further, this TIP does not describe limits or manufacturing parameters on weld repairs that may affect the serviceability of the roll. However, it is recommended that the matter of weld repairs be negotiated between the purchaser and supplier when a new shell is ordered, and it may be desirable to reference this TIP in the agreement. Welding performed on in-service suction roll shells in an attempt to repair handling damage and fatigue cracks is also excluded from this TIP.

Safety precautions

There are no safety precautions relevant to this document.

Weld repairs

Modern suction roll shells are made from a variety of bronze and stainless steel alloys. Shells are most commonly produced by centrifugal casting or by rolling and welding plate (stainless steel only). Despite good efforts in controlling quality of suction roll shell fabrication, flaws are occasionally present. Typical flaws that may require welding are shrinkage porosity and inclusions from casting, or cracks and surface defects from plate rolling. Flaws may also be produced during drilling or by accidental machining or handling damage. In some cases, when flaws are discovered in shells during the manufacturing stage, it is desirable that weld repairs be made to improve the runnability of the shell. In other cases, it is best to avoid weld repair of the flaws or to scrap the shell.

Weld repair procedures exist for all current bronze and stainless steel shell materials, although some alloys are more weldable than others. Weld filler metals may be matching (the same composition as the shell material) or nonmatching. An example of a nonmatching filler metal is the use of austenitic stainless steel filler rod to weld repair a martensitic CA-15 stainless steel shell when post-weld heat treatment is not possible. Austenitic filler material is used because it has a lower propensity to crack when welding martensitic stainless steel.

Important considerations when weld repairing flaws are the size, location, and type of flaw in the shell. For example, some flaws may not need repair if located near the ends of the shell, since this is a low-stress region that is less prone to fatigue cracking in service. Cracks and other linear flaws are more detrimental to shell service life than rounded inclusions or porosity; clustered flaws are of more concern than widely spaced, random flaws of similar size.

Another consideration for stainless steels is whether welding will be followed by heat treatment to produce a more favorable microstructure and lower residual stresses. (Bronze suction roll shells are usually not heat treated.)

Weld repair alone or heat treatment of weld repairs on a finished stainless steel shell may cause distortion. This may be remedied by re-machining, provided dimensional tolerances are met. Additional heat treatment may also affect a material that was control-cooled following casting, or given an aging or other special heat treatment to optimize its properties. Repair welds made on finished shells after final machining and without post-weld heat treatment generally produce high, localized residual stresses in the finished shell and may lead to premature cracking in service.

All of the above considerations apply for any size of weld repair. Weld repair of relatively small flaws to improve the "cosmetic" appearance of a shell can decrease the shell's expected service life. Therefore, even small weld repairs should be performed only after careful evaluation of the flaw location and the potential effects of welding on shell life. When welding is necessary on a new suction roll shell, the shell supplier, the machine builder, and the purchaser should agree prior to welding as to the allowable extent of repair. Alternate repair procedures (e.g., additional machining) also should be considered. Written procedures should be developed by the shell supplier for all repair welding. The procedure should describe preparation of the shell to remove the flaw before welding, details of the actual welding procedure, including type of filler metal, and preheat and post-heat treatment, if any. Nondestructive test methods, such as described in TIP 0402-11 (Liquid Dye Penetrant Testing of New Suction Roll Shells), should be used to ensure that the flaw is completely removed prior to welding and that the repair weld has acceptable quality. Radiography and ultrasonic testing can be used to detect subsurface flaws, although the coarse grain structure of many cast alloys can greatly reduce the effectiveness of ultrasonic testing.

Reporting

All weld repairs made on a suction roll shell should be carefully documented as to the size, location, procedure for welding, and whether post-weld heat treatment was performed. Documentation of weld repairs may be performed using the format shown in the following example. This documentation should be retained on file by the shell owner and supplier for the life of the shell so that the second objective of this TIP can be met.

Keywords

Vacuum rolls, Press rolls, Maintenance, Shells, Welding, Stainless steel, Bronze

Additional information

Effective Date of Issue: August 27, 2015.

Working Group Members:

Douglas Sherman, Corrosion Probe, Inc. – Chairman

Paul Glogowski, Valmet, Inc.

Max Moskal, M&M Engineering Associates, Inc.

Reference

TAPPI TIP 0402-11 "Liquid penetrant testing of new suction roll shells."