

Metallurgy for Industries

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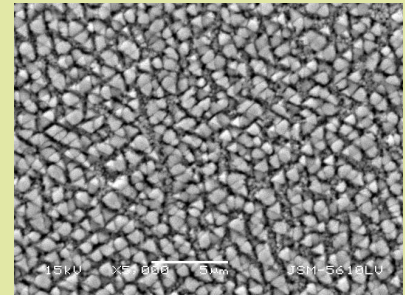
General norms for acceptance of ultrasonic and radiography quality steel casting

An insight on Quality Control of steel casting.

All the steel cast components having stipulation for ultrasonic and radiography testing are meant for critical requirement. Their poor performance in terms of either premature service failure or inability to attain stipulated proficiency would jeopardise the entire operation. Normally their premature failure or under performance will have implications in form of forced outages, safety considerations and formidable production and output loss. Following are the general guidelines to ensure formal quality acceptance standards.

1. **Chemical composition** – This requires to be checked on an integrally cast test block with the help of NABL approved material testing laboratory. It should conform to the stipulated material specification. Normally any deviations are not acceptable. Even the minor deviations are to be carefully weighed vis-a-vis national/international standards for permissible deviations, in consultation with the purchaser/designer.
2. **Residual gas content**- In general no stipulations are made for residual gas contents. It is advisable to check hydrogen, oxygen and nitrogen from integrally cast test block after random sampling. On heuristic consideration, recommended permissible levels are as under. Hydrogen- around 5 ppm, oxygen -around 40-50 ppm and nitrogen- less than 120ppm. The values higher than the limits indicate casting susceptibility for poor performance.
3. **Mechanical properties**- They are to be tested from the test bar machined from integrally cast test block. The testing must be carried out by NABL approved material testing laboratory

Microstructure of the Month



Magnification:5000X

Etchant :10%CrO3

MOC: Inconel 738LC

Component: Gas turbine blade

Observation: is the high magnification view of the gamma prime precipitates. Their morphology is cuboidal / triangular in shape.

Useful hints: Morphology of gamma prime determines the useful service life of the component. Metallography approach determines the remaining life of the blade and also indicates the possibility of rejuvenating the costly gas turbine components.

with all the testing machines shall be having proper calibration status as per NABL requirements. The properties should conform to stipulated values in material specification; otherwise the castings are treated as rejected from the entire heat number.

4. **Ultrasonic testing** – It shall be done in the machined condition of the casting with the help of calibrated ultrasonic testing equipment by qualified inspector. Calibration should conform to the stipulated standard and acceptance levels. the Ultrasonic machine used for the testing should be properly calibrated by using stipulated UT reference block specified in the respective material specification. Performance of Ultrasonic testing machine should be verified by using reference block every time the testing is to be carried out.
5. **Radiography**- It should be carried out as per the stipulation standard maintained in the technical delivery condition by a qualified inspector. Also, radiographs shall be reviewed by qualified and experienced personnel.
6. **Hydro testing** – This is mandatory for all those castings meant for pressure containing parts. It shall be carried out as per the stipulated standards and conditions.
7. **Microstructure** – Although this test is not mandatory for most of the castings, it is advisable to check microstructure to ascertain proper melting practice and heat treatment condition. Some subtle changes in the process parameters, which may not reflect in any of the testing mentioned above and may have serious consequences on service conditions can often be explored with microstructure study. As kaizen approach for improved quality, a proper build of data is required over a period of time to evolve in house acceptance norms. This even includes level of inclusions for which no standards are available

Normally all these critical castings should carry proper melt number and serial number in cast condition- preferably on un-machined faces for their identification. Often magnetic particle testing or dye penetrating testing is recommended after machining and hydro testing to ensure improved quality.

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