

Fit for purpose

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Engineering consultancy and related services within the cement sector have been around for quite some time now and will be required into the future. With over 50 years of working and consulting within the industry, Atkins describes a typical, time-honoured engineering consultancy service provided by the company.

When considering the risks to a cement plant's business plan in terms of delays to start up or expensive re-work and increased maintenance costs, it makes sound business sense to invest in 'building in quality', by performing factory acceptance tests for a new cement plant project or for major maintenance refurbishment of equipment. In the author's experience, the benefits of carrying out this exercise with the right specialists on board outweigh the costs of not doing this, every time.

General purpose

The general purpose of a factory acceptance test is to ensure that a new piece of equipment is 'fit for purpose' before releasing the equipment for delivery to site for installation.

After agreeing a quality control plan with an equipment supplier as part of contract negotiations, the Factory Acceptance Test is the most significant activity within the overall plan. Depending



Vertical roller mills are packaged after passing factory testing

on the complexity of the component and the manufacturing location(s), a number of inspection visits may be required prior

to the final factory acceptance test.

Once equipment has passed a factory acceptance test, it is ready for shipment to site to be installed.



Mill main drive no-load test

Rationale

The general principles to consider for the cement plant owner when making the decision to perform and prioritise the number (and therefore the costs) of inspection visits are:

- if major components arrive at site and are not acceptable and re-work is not an option, what are the 'lead times' for ordering new components or returning the components back to a supplier for re-work, re-test and the re-shipment? For major items typical in a cement plant project, eg raw mill and cement mill, girth gears, motors, pinions and main gearboxes, the main process fans, the main clinker cooler components/drive systems, the heat exchanger – the reorder or rework with such critical components can mean six months and more of delays

and significantly affect a new cement plant's project erection, commissioning and completion schedules

- in Atkins' experience, the items suggested for factory acceptance testing would include components it would normally classify as 'critical insurance' spares and would not normally be included within 'start-up and commissioning' spare parts, as supplied by the equipment supplier. If there were an early failure to any of these components, there would be significant downtime in production, which has regularly occurred around the world and which significantly affects the business plan of a cement plant
- if the component or equipment arrives at site without complying with equipment specifications, can modifications be made at site or is specialist knowledge and machinery required? If such re-work is required, what are the warranty implications? The same rationale can be used whether there are a number of components being manufactured as part of a new cement plant project or if it is a major item being replaced at a cement plant during annual maintenance (for example, a main vertical roller mill gearbox or main kiln girth gear).

Over the years, Atkins has refined its approach to make cost-effective use of specialist time to prioritise critical equipment inspections depending on the cement plant

About Atkins . . .

Atkins undertakes the full range of consultancy to the cement, lime and other heavy industry sectors, including:

- pre-investment studies
- feasibility studies and project risk management
- commercial, technical and environmental due diligence
- banker's engineer – monitoring of erection and operations
- expert witness
- financial modelling/appraisal and company valuation
- environmental impact studies
- market and economic studies
- privatisation
- troubleshooting and performance improvements
- factory acceptance tests
- tender analysis and contract negotiations
- site supervision of plant and equipment installation
- geology, hydrogeology and land surveying
- raw material assessment and raw mix design
- preparation of technical specifications, drawing and contract documents
- mechanical engineering design and supervision
- civil design and supervision
- electrical engineering, instrumentation and process control design and supervision
- start-up assistance
- project management of capex programmes
- industrial carbon management including EU ETS impact assessment.



Testing girth gear pinion shaft

would normally be expected and witness-checked (if practical) to confirm the equipment suppliers' dimensional records are reliable. In addition, a variety of physical inspections of the finished equipment would take place to review elements of the quality documentation. Particular attention is required for tolerance-fit items to ensure typical industry standards have been followed and that a manufacturer has followed its own internal procedures.

As part of a normal service a general inspection of the capability of the manufacturing facilities being used would be investigated to understand quality control procedures and typical tolerance capability of the machinery being used to manufacture components.

Finally, for certain components it would be usual to witness 'no-load test runs' for items such as main mill gearboxes.

Range of standards

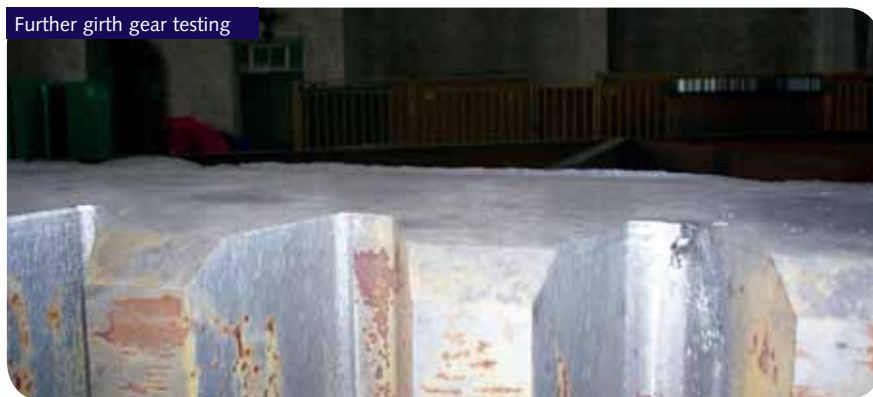
Experience over the years has shown Atkins that most major critical components for cement plants are manufactured within Europe, the USA, India, Japan and China. A lot depends on the philosophy of the cement producer when agreeing contracts and placing the initial orders. Standards vary significantly with respect to attitudes towards quality control procedures during manufacture.

This range in standards inevitably has a cost implication for factory acceptance testing support. In Atkins' experience, the lower the quality control standards during manufacture, the greater the costs involved with factory acceptance testing and monitoring manufacturing quality.

Approach

The principles, approach and philosophy of the consultant and the cement plant owners need to be explored thoroughly at the start of a project to ensure that there is a suitable match. Choose consultants and equipment suppliers wisely when supporting a project in this area.

Spending money for quality support during the factory acceptance testing phase, at the beginning of a project, can save a wide variety of associated costs at a later date for expensive design variations, legal cases, etc, to rectify problems that could have been highlighted in the beginning during factory acceptance testing.



Further girth gear testing

owner's philosophy and budget. This approach has been appreciated by clients wishing to prioritise the essential items first when it comes to preventing key equipment arriving at site and being unfit for purpose.

As part of this prioritisation process, assessments and discussions are required with the cement plant owner about the local availability and experience of specialist machinery and engineering workshops. Different environments offer different challenges such as the differing operational constraints (eg access to site for major equipment) of building a works in the desert, jungle or urban surroundings.

Inspection activities

Typical inspection activities during a factory acceptance test will include a review of:

- quality inspection plans
- general arrangement drawings

- steel material records
- sub-component supply records
- fabrication records
- equipment critical dimensional checks
- welding qualifications and test piece records
- non-destructive testing records
- calibration records of measuring equipment
- suitability of the design for the application
- control and instrumentation systems
- condition-based monitoring tools and systems
- packing list
- packaging plans
- shipment insurance policies (it would not be the first time that major components are damaged due to high seas during delivery and as such the components have to be returned to the factory for re-work, re-test or replacement).

Some 'spot checks and re-measurements' of critical dimensions