

REVERSE ENGINEERING

Reverse Engineering of Flender twin input single output gearbox for steam turbine generator drive in Waste to Energy plant located in Coventry.

With a population of over half a million people, generating 250,000 tonnes of domestic waste each year, Coventry City Council and the Metropolitan Borough of Solihull deploy a range of waste treatment technologies to ensure that waste is disposed of as efficiently and cleanly as possible.

One of the municipal waste treatment facilities is the state-of-the-art Waste to Energy plant located in Coventry. The plant handles over 200,000 tonnes of waste each year representing around 80% of the total handled by the two municipal authorities.

At the heart of the operation are three incinerators, operating seven days a week, 365 days per annum. Waste is incinerated at a temperature in excess of 950°C and steam is raised which is used to drive two turbines to generate electricity and also to provide heat in the form of high pressure hot water to a local factory.

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REVERSE ENGINEERING

Coventry Waste

The two steam turbines are driven by a speed reducing gearbox into a single generator.

The plant was commissioned in 1975 and over the years, there have been modifications and improvements to the plant and the operating strategy. The changes have been driven by legislation and a desire to improve the plant efficiency.

Overview: Why Allen Gears won the order

- Troubleshooting expertise analysing failure
- Reverse engineering skills offering solution
- AG ingenuity to ensure unit continued operation whilst new component manufacture under-way
- New design to ensure reliable consistent operation
- Installation and commissioning in short timescale to minimise downtime.

Background

In Summer 2006, Allen Gears were asked to investigate after the original gearbox was experiencing high vibration. The unit had not had any maintenance carried out for many years. The application is critical, with any gearbox downtime resulting in lost revenue to the end user; therefore a quick, reliable and professional response was required.

Allen Gears attended site to analyse the gearbox. Upon inspection it was determined that the pinion had suffered tooth damage, and would need to be replaced. The pinion was removed and returned to Allen Gears where we conducted the following:

- Dimensional checking to enable reverse-engineering
- Dressing of pinion to allow machine to continue operation whilst new part was being manufactured
- Crack detection of pinion to ensure no more damage would occur in short term
- Re-balancing.

The dressed existing pinion was then returned to the site and re-fitted, this all ensured that whilst the new component was being manufactured, the unit could continue operation for a number of weeks at reduced load.

As no manufacturing drawings were available, using the dimensions that had been taken from the pinion, Allen Gears designed a new pinion to fit into the existing installation and with the existing gear wheel.

Once the manufacture was completed the new pinion was sent to site where Allen Gears Service Engineers fitted it into the existing gearbox, and conducted mesh checking. Carrying out all the operations in-situ, ensured the lowest possible downtime of the unit, which was very important to the customer.

Even with the new pinion fitted, the end user knew that this unit was reaching the end of its working life, so following the successful work conducted by Allen Gears, we were asked to design a completely new gearbox to fit into the existing space envelope of the package.

The unit was designed and manufactured to Allen Gears standards, but within the constraints of the package size which was fixed within its housing. The order included successful installation and commissioning of the unit in the shortest possible time to ensure that downtime was kept to a minimum.

Technical Data

Application:	Steam Turbine Driven Generator
Installation:	Coventry & Solihull Waste to Energy plant, UK
Gear Manufacturer:	Flender-Graffenstaden – TSD 75Sx
Gearbox Type:	Twin Input, Single Output parallel shaft gearbox
Power:	13,600 kW
Speeds:	Input 1: 11,203 rpm Input 2: 5,601 rpm Output: 1,500 rpm



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