STEAM TURBINE UPGRADES

Typical Technical Proposal

This modification upgrade is based on a turbine unit removed from site and returned to HTS for upgrading and refurbishment. It assumes that all major castings and the wheelshaft assembly are in reasonable condition and that repair excludes major weld repairs. Hayward Tyler will supply all standard wearing parts and sealing components. The objective is to provide a complete 'current' turbine incorporating all the various upgrades made on this design of unit which have evolved throughout its operational life:

- Horizontal Woodward governor providing better speed control & response time
- Bearing isolators to prevent lube oil contamination & improve bearing life
- Material upgrades and revised arrangements to external linkages to prevent corrosion & seizure
- New 2-part stuffing box with 4 carbon rings per box for improved steam sealing
- Tighter dynamic balance specification for improved rotor stability
- New design positive shut-off trip valve to replace problematic butterfly trip valve

These upgrades will be engineered with the aim of ensuring that the upgraded unit can be retrofitted to the existing bedplate and inlet/exhaust pipework without complication. We would require the specific serial number of each individual machine to ensure parts compatability and that minor drains, gauge or bypass pipework will not need modification on site.

Scope of Supply - Refurbishment

The following outlines the normal activities for T100/TS200, T400/TS600, HT200/HT600 (Z and G type Hayward Tyler Terry Turbine) rebuild and test, excluding any specific improvements:

a) Receive, strip down, inspect, size & issue 'as received' Inspection Report
b) Conduct casing dye penetrant NDT
c) Manufacture / procure all wearing / sealing components & required parts necessary for rebuild
d) Polish shaft journals at bearing and carbon locations
e) Sub-assemble rotating element c/w trip hub & coupling half
f) Dynamic balance rotor to Grade 2.5
g) Rebuild turbine, completing 'as built' Inspection Report as required
h) Conduct necessary no-load live steam testing work in accordance with recognised Turbine Test procedures
i) Paint & prepare turbine for return to site, deliver to site

These services are also available for the Hayward Tyler range of skinner HT150, HT1200 and the HT2200 (SK11, S23, S28). Should you require further clarification or assistance, please do contact us.

To obtain a quotation or for further information please contact us on +44 (0)1582 731144 or email us at service@haywardtyler.co.uk

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HAYWARD TYLER

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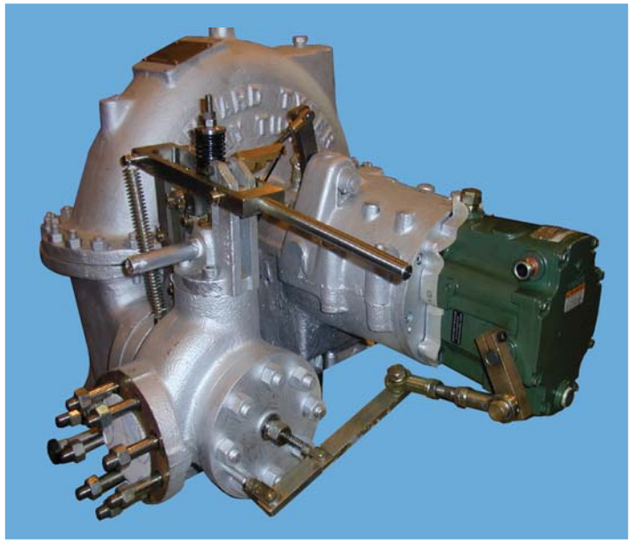
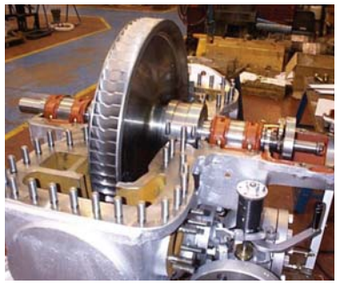




OEM: **Hayward Tyler**
For types: T100/TS200, T400/TS600, HT200 / HT600
Z1 & G Type Hayward Tyler Terry

Hayward Tyler Services offer a comprehensive range of aftersales services for our own and other OEM pumps, motors and turbines. We can provide replacements or upgrades **for steam turbines that will deliver** much greater efficiency and reliability and in turn meet today's more stringent health and safety regulations.

Hayward Tyler Services **provide a number of upgrade options** to cover the refurbishment, rebuild, no-load testing and return of a Hayward Tyler T100/TS200, T400/TS600, HT200 / HT600 (Z and G type Hayward Tyler Terry Turbine) General Purpose Process Steam Turbine. This datasheet summarises the scope of supply **for refurbishment** and the benefits that you can expect.

Benefits of upgrading your steam turbine

- Improved trip repeatability
- Improved meantime between failures
- Easier operation
- Noise reduction
- Prolonged bearing life
- Greater efficiency
- Positive shut-off

Hayward Tyler HT 200 - General Purpose Steam Turbine Upgrades

Woodward Hydraulic Governor Conversion

Removes original style linkage with a robust solid section and spherical rod end bearing arrangement which gives superior rigidity, less pick up on actuation and therefore an improved repeatability on the trip and control action.

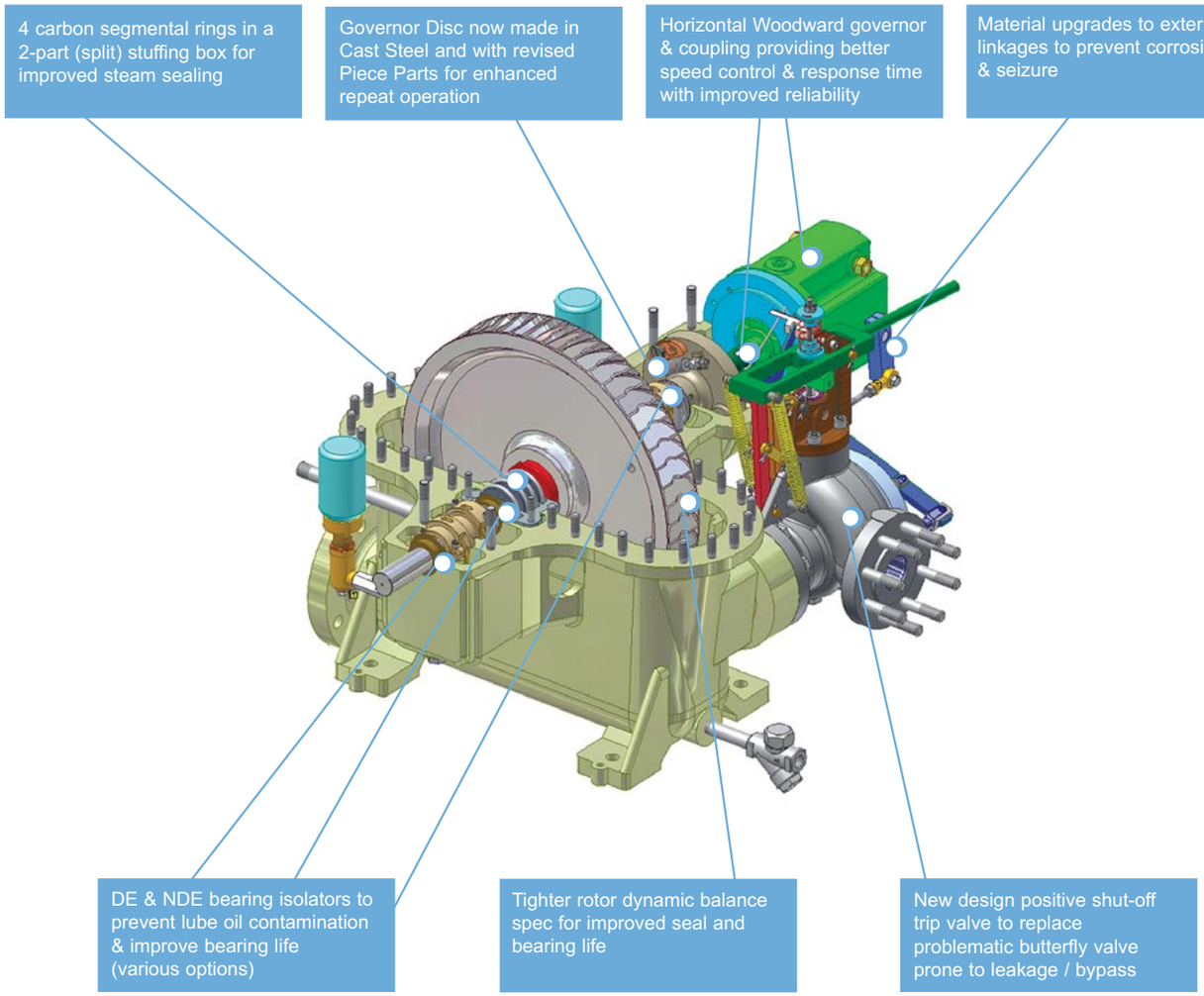
Fitment of Woodward Hydraulic Governor requires removal of fly ball mechanism removing weights and levels and the radial stresses that this generates on the radial bearing. We have found that by upgrading to the Woodward mechanism there are substantial gains in respect of mean time between failures of the radial bearing arrangement. There will then be a reduction in noise and vibration generated by a fly ball mechanism, thus increasing operational life, giving greater repeatability on over speed trip mechanism and gives a significant improvement in safety and reliability.

Positive Shut off Trip Valve

Original design Hayward Tyler Terry Turbines were not designed or manufactured with a positive shut off, just an over-speed trip. Positive shut off will completely block off the steam supply to ensure the turbine comes to rest. Under over-speed or 'run away' condition, due to coupling failure or loss of drive the over-speed mechanism will activate the positive shut off valve to ensure steam supply is removed and therefore the turbine will come to a complete rest, an essential safety feature under any health and safety review.

Drive End and Non Drive End Bearing Isolators.

Upgrading to 'impro' seals prevents lube oil contamination stopping steam from entering into the bearing housings and reducing bearing life.



Carbon Packing Ring Box

We are able to increase the original carbon packing box from a 3 to 4 ring arrangement for greater steam sealing and retention of unwanted moisture. The carbon packing box is designed as a horizontal split case module for ease of assembly.

Balance of Rotating Assembly

For build up of the rotating element, the complete assembly, including governor disc module, is balanced to a tighter dynamic specification with the benefit of improved seal, ring and bearing life.

Governor Disc Assembly

The existing governor disc module, with the help of end users and shop floor build, has been modified to include needle roller bearings on trip weight and pin for reduced friction and enhanced reaction. Fixed 'shouldered' pin length will ensure repeat build and 'non' trap of mechanically moving parts plus the disc itself is now made from cast steel not cast Iron.

Further peace of mind...

- Original Equipment Manufacturer
- All design and engineering data available
- Extensive product knowledge
- Historical data
- Technical support
- Stock of common parts
- Experienced specialist fitters
- Turbines tested on steam
- Proven experience
- Modifications / upgrades come as compatible and interchangeable kits.

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www.**haywardtyler**.com