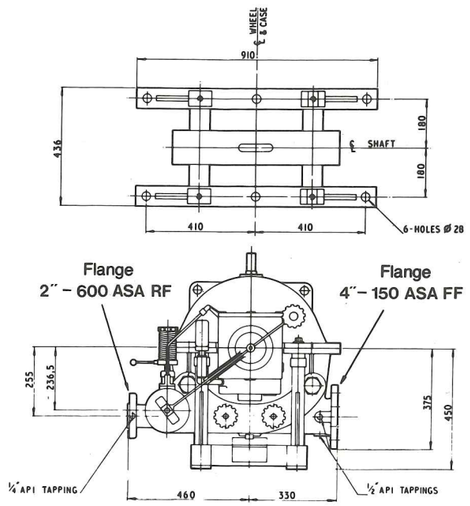
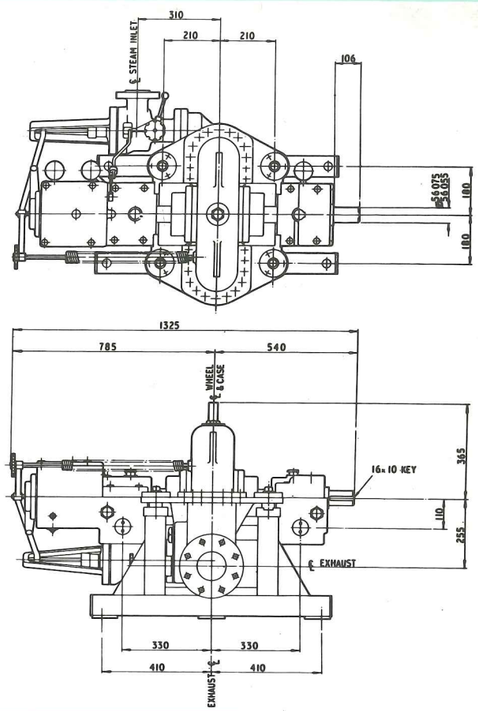
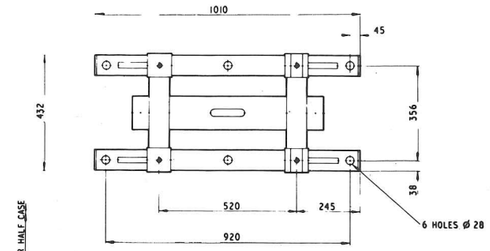
TC-18 Principal dimensions in mm

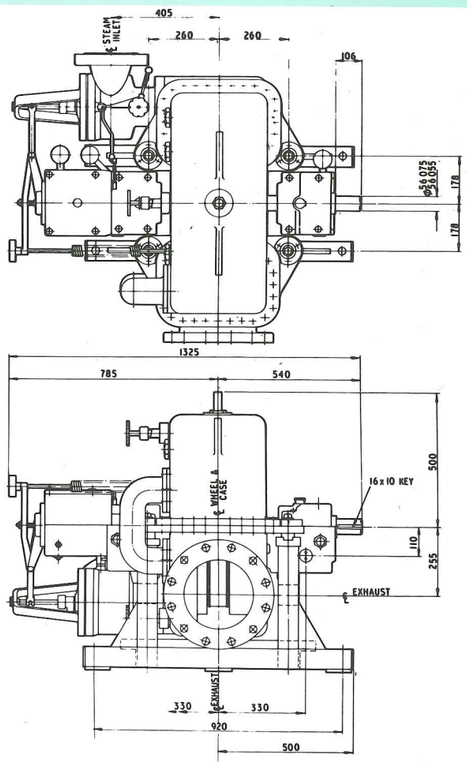




Steam and exhaust openings shown on these drawings are our standard for this frame. Purchaser must install pipes of sufficient size to ensure rated **steam and exhaust pressure at the turbine**.
Steam pipes should be lagged and a separator installed as close to the turbine as possible. Dry steam means better efficiency and longer life for the turbine.

TC-24 Principal dimensions in mm

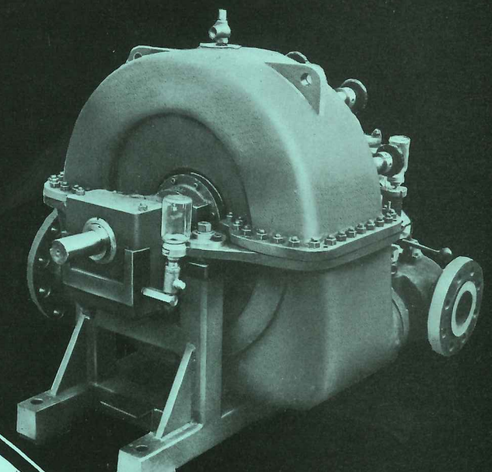




Hayward Tyler

Hayward Tyler TC range of steam turbines

Centre-line mounted general purpose turbines to the American Petroleum Institute standard (API) 611.



TC-18 and TC-24

Range of back pressure turbines

These turbines are extensively used as prime movers for Fans, Blowers, Compressors, Pumps, Mixers and Turbo-Alternators by the following industries; Chemical Manufacturers, Dyeworks, Laundries, Oil Refineries, Paper Mills and Sugar Refineries. Food, Process, Soap and Textile factories. Breweries, Distilleries, Dairies, and Power Plants for auxiliary drives, for land and marine applications.

Principle

The turbine is basically a single wheel, mounted on a shaft, carried in sleeve bearings and enclosed in a pressure-tight casing. Carbon packing rings, between wheel and bearings, prevent the escape of steam along the shaft.

Steam, entering through a valve controlled by a centrifugal governor, passes to the jets via an emergency governor valve. Each jet directs the steam into the wheel buckets. The steam gives up part of its energy in rotating the wheel, and is then collected in a reversing chamber which redirects it to the buckets. This process is repeated until the steam, having given up most of its energy, is exhausted into the casing which is connected by an exhaust pipe either to a steam process plant, the atmosphere or a condenser.

The number of jets used depends on the power required from the turbine.

Turbine Selection

Turbine selections are computer-aided to ensure that maximum efficiency with minimum steam consumption is achieved.

Factors which affect steam rates are:

Speed

Increased speed results in improved steam rate, the use of a reduction gearbox between driver and driven machine can achieve this.

Total Temperature

Increase in total temperature improves steam rate (degree of superheat)

Inlet Pressure

Increase of inlet pressure improves steam rate.

Where a turbine may be required to give a lower power output than the maximum for which it is supplied, hand valves are fitted to enable one or more jets to be shut off, thus maintaining maximum steam economy at partial load.

Construction features

Casing

The casing is mounted on the centreline to offset the effects of expansion at the coupling and to ensure proper alignment with the driven equipment. The case complies with the ASME pressure vessel code Section VIII. The maincase joints are subject to exhaust pressure and temperature only.

Casing, bearings and governor housing are all split horizontally, allowing the turbine to be dismantled without disturbing alignment or inlet and exhaust pipework.

Support Arrangement

The turbine stand supports the casing at its centreline to reduce vertical misalignment while a system of keys reduces the relative axial movement of the coupling shaft end to a minimum.

Wheel

The wheel is manufactured from a single forging with semi-circular buckets milled from the solid metal. The blades have large clearances and are protected by shrouds at the sides of the wheel. Radial flow minimises end-thrust. The rotating assembly is dynamically balanced.

Shaft

The shaft is of stiff construction with the critical speed well above maximum trip speed.

Carbon Sealing Rings

Four carbon sealing rings are fitted each side of the wheel, three of which act to break down the exhaust pressure to atmosphere. The maximum allowable exhaust pressure in the casing is 90 psig resulting in a maximum pressure drop per ring of 30 psig. API611 allows up to 35 psig per ring.

The outer carbon rings prevent the possible ingress of steam into the bearing housing. Pipes are screwed into each housing to allow any small steam leakage to escape to the atmosphere.

The additional sealing ring at each end of the housing is also effective when exhausting steam to a condenser. When exhausting to a vacuum, low pressure steam is fed into the gland housing via interconnecting piping to seal against atmospheric pressure.

The bore of the carbon rings bear upon hard chrome shaft surface and the end faces of the rings seal against the sides of the labyrinth within the housing. The carbon sealing rings are enclosed in a separate housing horizontally split for accessibility and can be removed without splitting the main case joint.

Bearings

The journal bearings are horizontally split, white metal faced and are designed for oil ring lubrication. Where specified a force feed lubrication system can be fitted. The bearing housing is bolted and dowelled to the turbine case before final machining to ensure concentricity. The construction used is designed to keep the oil temperatures to a minimum.

Bearing housings are fitted with constant level oilers, sight glasses and oil coolers.

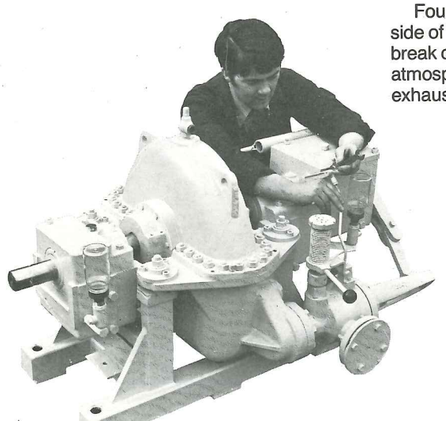
Rotation

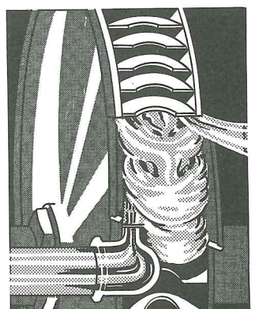
Standard rotation is clockwise looking on the turbine shaft extension. Counter-clockwise rotation can be provided if this is specified when ordering. This involves no increase in price unless the rotation has to be reversed after or during manufacture.

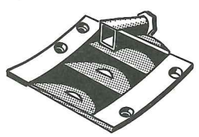
Quotations

When quotations are requested the following information is required:

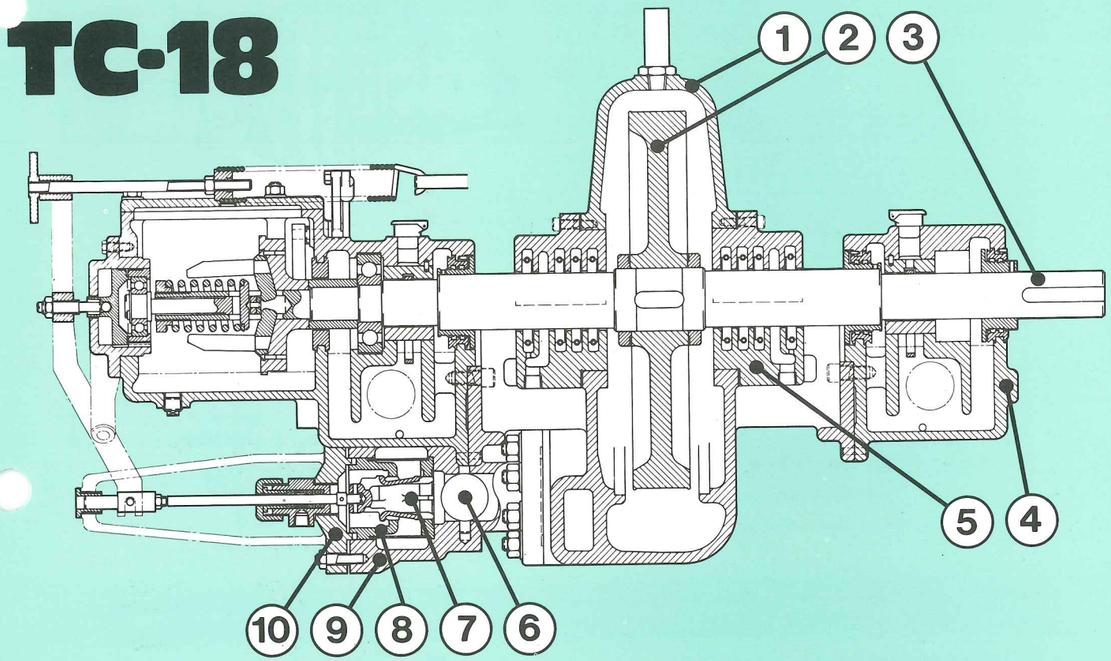
1) Power required.
2) Speed required
3) Steam pressure at inlet.
4) Steam temperature.
5) Exhaust pressure.



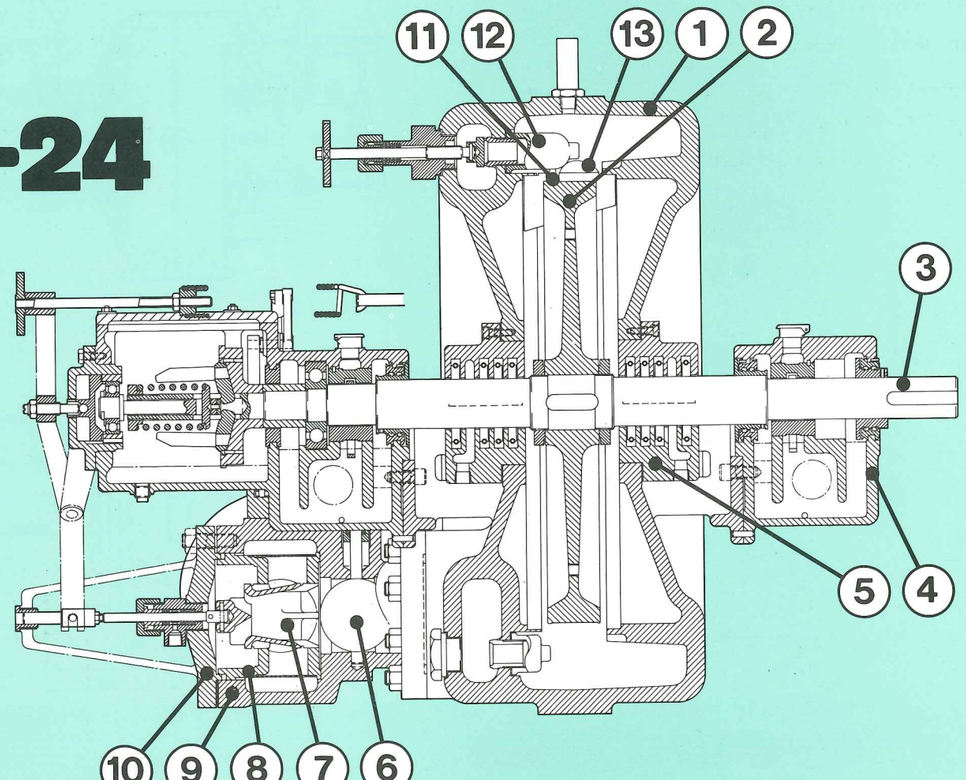




TC-18



TC-24



Specification

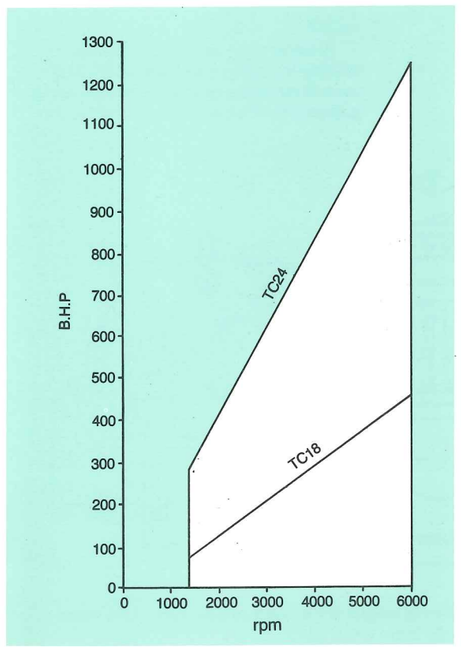
Item No.	Part Name	Material
1	Main casing	BS1504 – 161 Gr.B – cast steel
2	Wheel	BS970 503M40 (EN12) forged steel
3	Shaft	BS970 709M40 – 1% chrome moly steel (chrome plated under carbon seals)
4	Bearing housing	BS1452 Gr.17 – cast iron
5	Carbon ring box	BS3468 AUS105 – austenitic cast iron
6	Butterfly valve	13/4% chrome nickel steel.
7	Governor valve	Monel – nickel alloy
8	Governor valve cage	13/4% chrome nickel steel.
9	Governor valve body	BS1504 – 161 Gr.B – cast steel
10	Governor valve bonnet	BS1504 – 161 Gr.B – cast steel
11	Steam jet	Monel – nickel alloy
12	Jet body	BS1504 – 161 Gr.B – steel
13	Reversing chamber	BS1504 – 845 Nb – stainless steel

Turbine designations

The designations of the turbines are TC18 and TC24. The suffix 'H' is added to denote steam pressure and temperature above 450 psig and 260°C and the suffix 'F' denotes force feed lubrication.

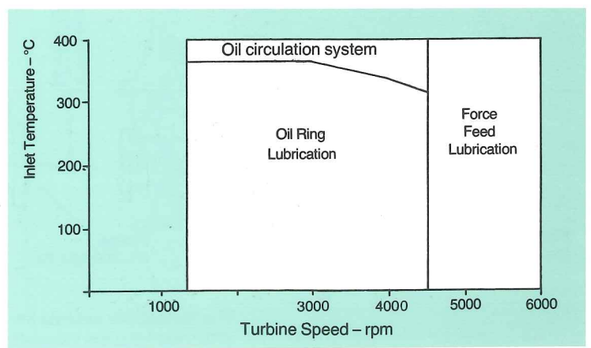
Operating conditions and limitations	Machine designation and limitations			
Turbine Designation	TC18 TC24	TC18F TC24F	TC18H TC24H	TC18FH TC24FH
Inlet Pressure Maximum psig	450	450	640	640
Exhaust Pressure Maximum psig	90	90	90	90
Inlet Temperature Maximum °C	260	260	360	400
Exhaust Temperature Maximum °C	—	—	350	350
Speed Minimum rpm	1400	1400	1400	1400
Speed Maximum rpm	4500*	6000	4500*	6000

*See graph below for speed against temperature for oil ring lubrication.

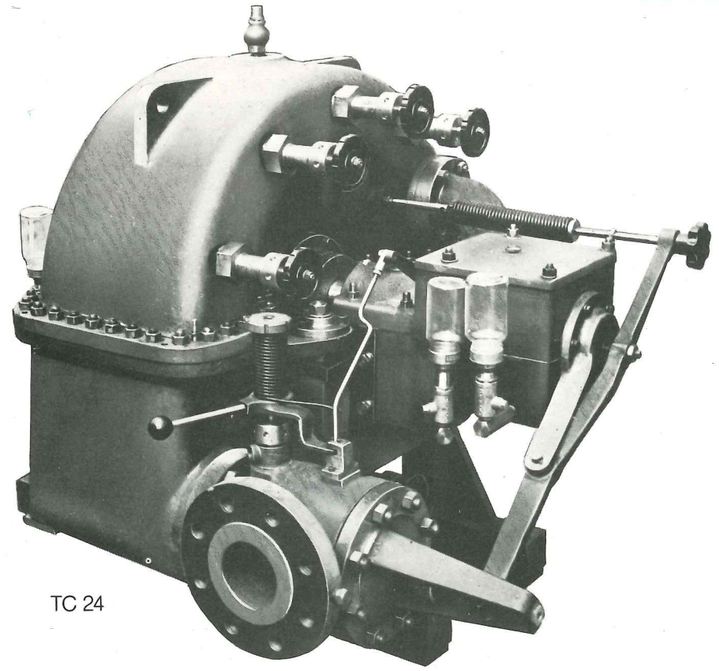


Power speed limitations for TC18 & TC24 Turbines

Speed/temperature for oil ring and force feed lubrication on TC18 & TC24 Turbines



Governors



TC 24

Mechanical System

This is a constant speed, fly ball type governor that is fitted as standard. Speed is normally variable within plus or minus 10 percent of the rated speed when the turbine is running by means of the hand speed-changer.

If the driven machine is a boiler feed pump or a machine with frequent but gradual load variations, it is recommended that a constant pressure regulator be fitted to the turbine.

Should the driven machine be an emergency generator, compressor, or any similar machine that imposes rapid and large variations in load, it is recommended that a Woodward hydraulic governor be fitted in place of the mechanical governor system.

Hydraulic System

A Woodward TG10, which is driven directly from the turbine shaft, will give speed control accuracy to NEMA A. The Woodward UG8, also driven directly from the turbine shaft, will give speed control to NEMA C, and is recommended for generator drives where close speed control is essential.

Emergency Governor Valve

The emergency governor valve is actuated by a mechanism separate from the main governor.

The valve can be re-set manually with steam on-line. Two versions are available, the butterfly valve and the globe valve.

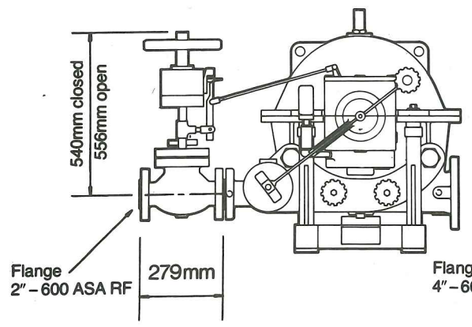
Butterfly valve

This is a spring-loaded unit used for duties up to 450 psig/260°C., and is an integral feature of the turbine.

Globe valve

A single seat quick closing valve suitable for use to 640 psig/400°C. The valve is mounted on the inlet flange and is operated by the standard trip mechanism.

TC-18H



TC-24H