



Tandem Steam Turbine for Cogeneration Power Plant (Optimization for Min. Load Operation)

POWER SYSTEMS HEADQUARTERS
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In power-generation facilities with steam turbines for cogeneration power plants, there has been a heightened need to operate the facilities at minimum load during nighttime hours and on holidays, when the electric power demand within factories for in-house power generation is low.

Mitsubishi Heavy Industries, Ltd. (MHI) has long been manufacturing tandem steam turbines in the 5,000-kW class using an engage/disengage clutch. MHI has recently designed and delivered a facility with a capacity exceeding 20,000 kW. The facility has operated smoothly since delivery. We introduce it here.

1. Product specifications

Table 1 shows the product specifications for the tandem steam turbine power-generation facility recently manufactured by MHI.

2. Product features

The electric power rates contracted with power companies now vary greatly from hour to hour, depending

Table 1 Product specifications for tandem steam turbine power generation facility

| Item | Specifications | |
|--|----------------------|--------|
| Back pressure turbine | | |
| Inlet steam pressure | (MPa) | 2.45 |
| Inlet steam temperature | (°C) | 360 |
| Exhaust pressure | (MPa) | 0.36 |
| Rotational speed | (min ⁻¹) | 6910 |
| Turbine output (at generation terminal) (kW) | | 10 300 |
| Condensing turbine | | |
| Inlet steam pressure | (MPa) | 0.35 |
| Exhaust pressure | (kPa) | -92.1 |
| Rotational speed | (min ⁻¹) | 6017 |
| Turbine output (at generation terminal) (kW) | | 10 700 |
| Generator | | |
| Rotational speed | (min ⁻¹) | 1 800 |
| Generator rated output | (kW) | 21 000 |

on whether consumers use power during the days, nights, and weekends and holidays. For customers who own steam turbines for cogeneration power plants, operation with the minimum required equipment at night and on holidays reduces the plant operation costs. In the case of general extraction condensing turbines (**Fig. 1**), operation can be continued at reduced loads by cooling the inside condensing zone of the turbine casing. To maintain this condition, a minimum amount of steam (about 15 to 20% of the rated amount) must continue to flow. The cost to maintain this flow of steam goes to waste.

In the tandem steam turbine equipped with the engage/disengage clutch (**Fig. 1**), on the other hand, the condensing turbine can be completely stopped while still maintaining the operation of the back pressure turbine. This eliminates the cost demerit.

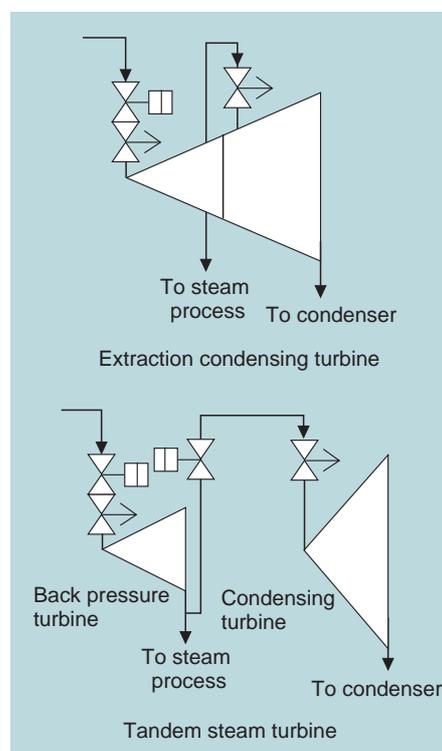


Fig. 1 Extraction condensing turbine and tandem steam turbine

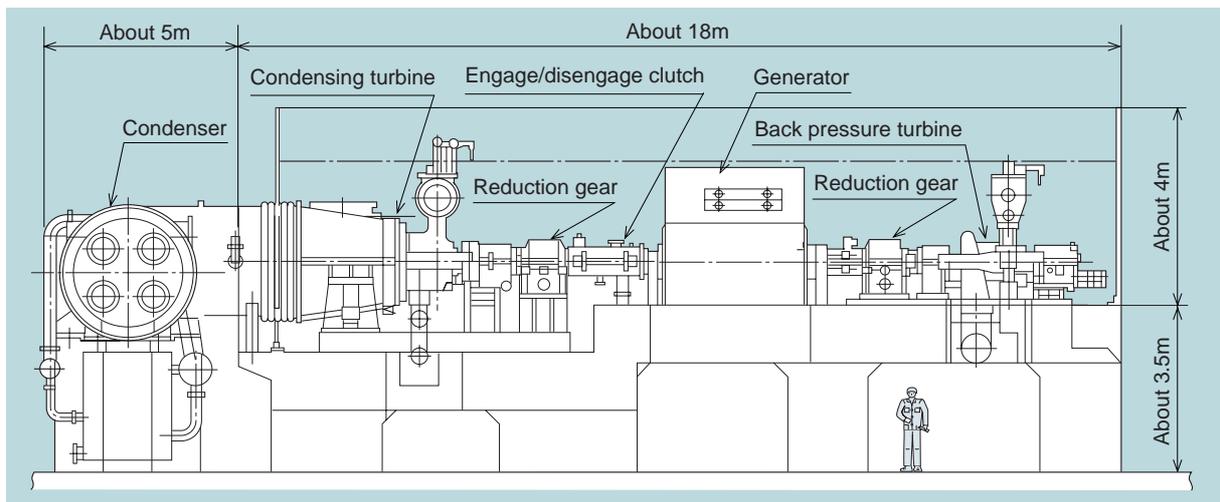


Fig. 2 Outline drawing of 21 000 kW tandem steam turbine

The adoption of the tandem type also brings in new cost factors, however, such as more turbine casings, more reduction gears, and the need for an engage/disengage clutch. Fortunately this does not lead to a large demerit, as the turbine casing and rotor structures are simplified compared with the extraction condensing turbine.

The most important new feature in the recently delivered product, shown in **Fig. 2**, is the ability to easily start and stop a condensing turbine with a capacity exceeding 10,000 kW (rated flow = About 100 t/h) everyday.

3. Development in the future

The electric power rates of domestic power companies are expected to be ever-more segmented in the future. The difference in the electric power demand between day and night will continue to increase even overseas (and the electric power rates will vary during the day and during the night). Thus, our future developments will be applicable even to turbines with larger capacities. This will allow us to meet the expectations of the users of cogeneration power plants, including those in foreign countries.