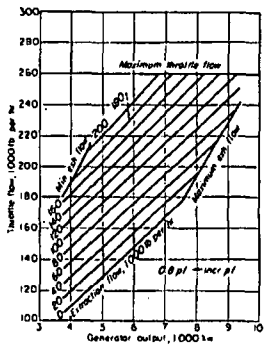
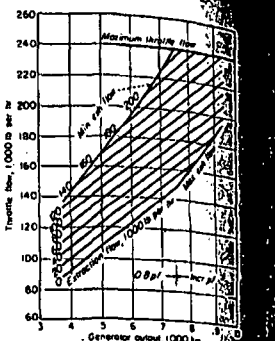


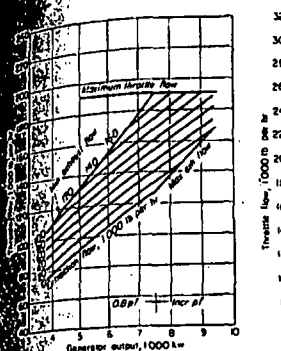
1 Noncondensing extraction turbine, 400 psig, 600 F, 50 psig, 150-psig bleed



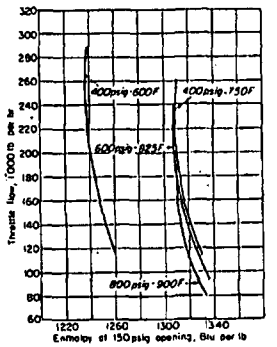
2 Noncondensing extraction turbine, 400 psig, 750 F, 50 psig, 150-psig bleed



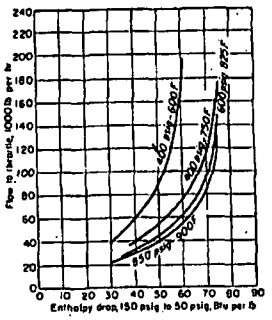
3 Noncondensing extraction turbine, 600 psig, 825 F, 50 psig, 150-psig bleed



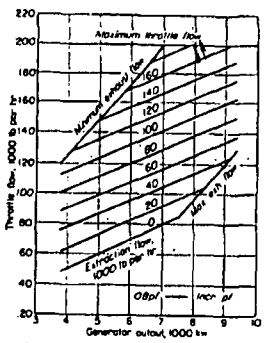
4 Noncondensing extraction turbine, 850 psig, 900 F, 50 psig, 150-psig bleed



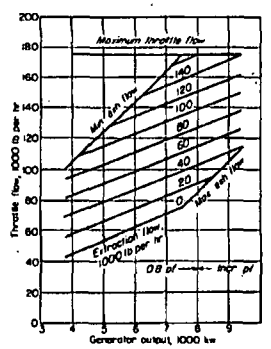
5 Noncondensing extraction turbines, relation between throttle flow, bleed h



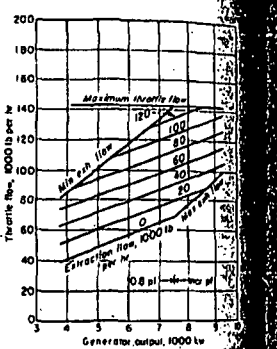
6 Noncondensing extraction turbines, relation of enthalpy drop to total flow



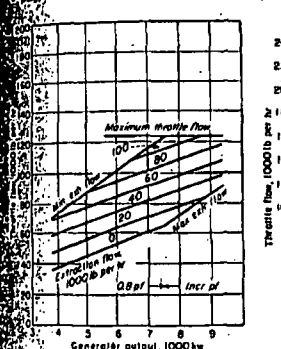
7 Condensing extraction turbine, 400 psig, 600 F, 2 in. Hg, 50-psig bleed



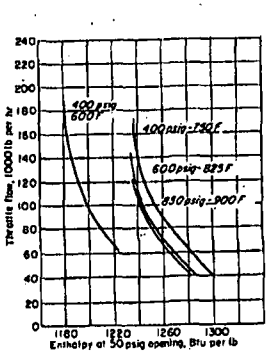
8 Condensing extraction turbine, 400 psig, 750 F, 2 in. Hg, 50-psig bleed



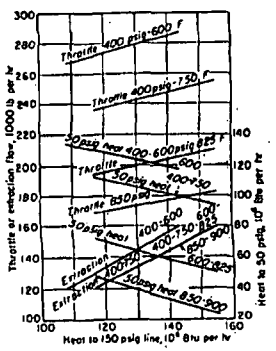
9 Condensing extraction turbine, 400 psig, 825 F, 2 in. Hg, 50-psig bleed



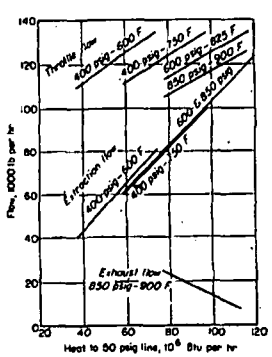
10 Condensing extraction turbine, 850 psig, 900 F, 2 in. Hg, 50-psig bleed



11 Condensing extraction turbines, relation of bleed enthalpy to flow



12 Noncondensing turbines, relations between steam flows and heat flows



13 Condensing turbines, relations between steam flows and 50-psig heat

How to Compare Automatic-Extraction Steam-Turbine Projects

Here are details of proper method to pick best turbine to serve dual power and process-heating demands in your plant

By E V POLLARD, *Section Engineer*
Turbine Engineering Division
General Electric Co

► COMPARING fuel consumption of automatic-extraction steam turbines at different initial steam conditions can be misleading if you use only a steamflow basis. We will develop here a step-by-step procedure for comparing fuel consumption on a constant heat-to-process basis. It's the logical way to compare alternate steam conditions since the process needs so many Btu per hr. Steam is only a medium for transporting heat, and *the quantity needed* for a process depends on the steam enthalpy, as well as the process heat needs.

We will cover a particular case of a noncondensing extraction turbine and a condensing extraction turbine, to simultaneously supply power and heat to a plant. Assume that total heat demand at each opening equals the sum of process and feedwater-heating requirements.

Table II, p 99, outlines specifications of a new boiler and turbine installation to supply power and heat. In an actual case, a number of loads and corresponding heats to process and *operating hours* would be studied. These additional points would also be calculated as shown in Table I, see the top of p 98.

Maximum byproduct power with minimum flow to condenser is the primary objective of these industrial applications. Evaluation of different steam conditions indicates the most economical initial pressure and temperature. In such evaluations, consider future process requirements also.

In Table I, the 400-psig 600-F conditions are the present operating levels. For comparison, we have selected initial conditions of 400 psig, 750 F; 600 psig, 825 F; 850 psig, 900 F as modern levels for this method of turbine application.

Obtain from the turbine manufacturer noncondensing-extraction-turbine performance curves, Fig. 1, 2, 3 and 4, and the corresponding enthalpy curves, Fig. 5 and 6; also condensing extraction turbine performance curves, Fig. 7, 8, 9 and 10, and corresponding enthalpy curve, Fig. 11.

First part of Table I, *Derivation of extraction and throttle flows*, uses data from these figures to work up performance data for each steam condition at a particular load. These data are inter-