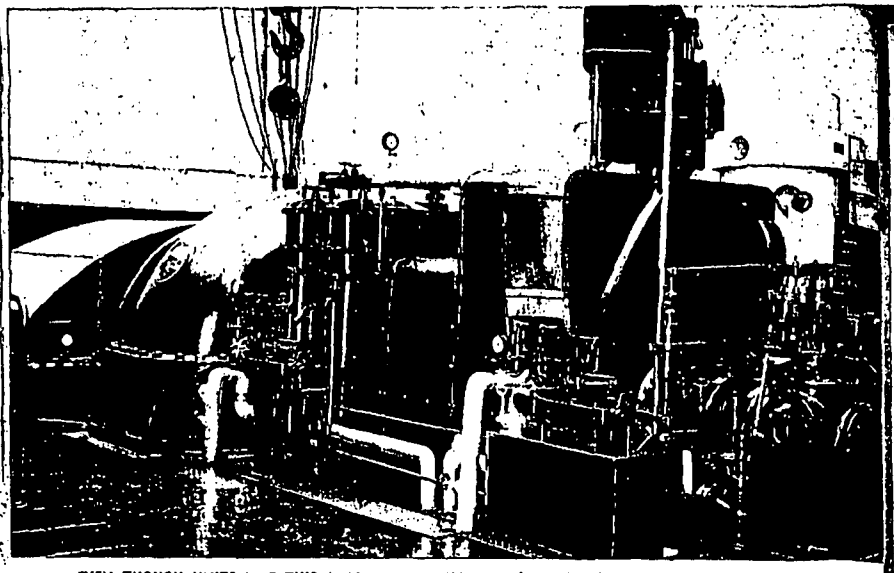
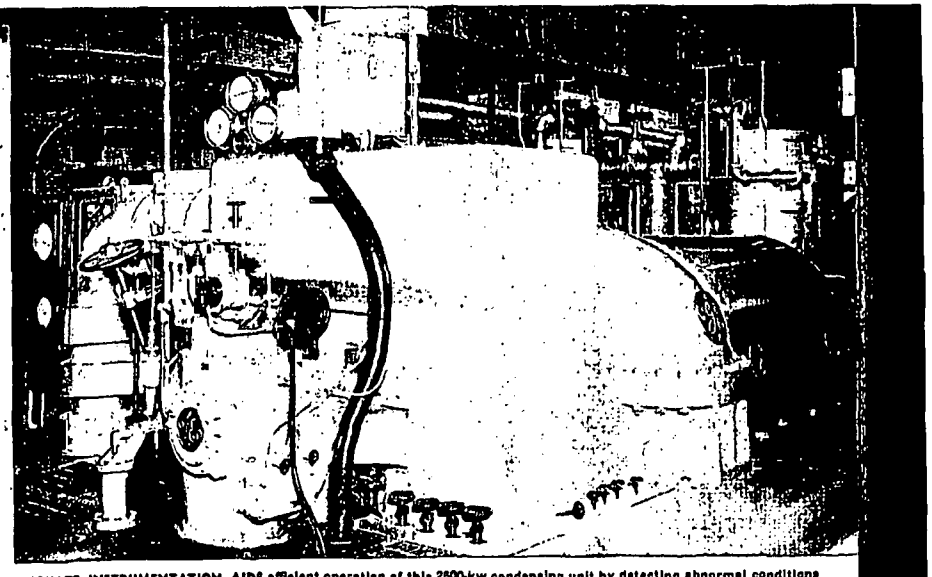


EVEN THOUGH UNITS LIKE THIS turbine run smoothly up to inspection time, resist an urge to postpone dismantling



ADEQUATE INSTRUMENTATION AIDS efficient operation of this 2500-kw condensing unit by detecting abnormal conditions

Establish Adequate Maintenance Program for Industrial Turbines

Protect investment, minimize operating costs by taking steam turbines out of service for inspection at regular intervals. Alf Hansen, turbine specialist, General Electric Co, tells what to look for and how to correct troubles at the start

▶ A GOOD MANY INDUSTRIAL COMPANIES operate their power plants with little or no standby capacity. And yet a forced shutdown for one day may cost a company the equivalent of the average annual profit on the power plant. Best way to insure continuous power-equipment operation is to establish a planned schedule of inspection and maintenance.

Some of the gains from a generating installation are lost if an extraction steam turbine is not available and boilers feed process steam direct to low-pressure lines. Modern turbines, among the most reliable prime movers today, accustom operators to smooth, continuous operation. So they are occasionally tempted to postpone inspection periods until definite indications of faulty operation develop. Nevertheless, planned shutdowns for inspection (1) reduce forced outages (2) produce reliable power at minimum cost (3) insure safety of personnel and property.

After a sound maintenance schedule has been established, don't gamble by running a turbine a year longer just because it seems to operate smoothly at the time of a planned shutdown.

Spare Capacity. Most continuous-process plants of medium size or larger have standby equipment. Plants with a spare turbine-generator have no difficulty adhering to an established maintenance program.

When erected some plants have standby units, but increased production demands require all units to be on the line continuously. So production must be curtailed during inspection periods and inevitably equipment does not receive necessary attention. Attempts are made to crowd a 2-week inspection period into a long weekend, but a more practicable procedure would be to take down the powerhouse equipment during a 2-week annual-vacation shutdown for the entire factory.

INSPECTION FREQUENCY

No general rule for frequency of inspections can be applied to all industries or even to all plants within the same industry. One large industrial concern operated a turbine for eight years without an internal inspection. Again, a hospital plant ran two small turbines 12 to 14 years without lifting the upper half of the turbine casing. Undoubtedly these power-plant operators had good reasons for their disregard of conventional maintenance schedules, but this practice cannot be recommended generally. Moreover these operators will probably be the first to agree that shorter intervals between inspections are desirable for both safety and economy.

Another industrial concern, operating three 2000-kw condensing turbines, at one time spent from three to four weeks for annual inspection, cleaning and overhauling of each unit. Their accurate records show that *money for this work was returned in fuel savings within two months after the equipment went back on the line.*

Some 10 or 15 years ago manufacturers recommended annual turbine inspections and many users still adhere to this conservative practice. Today, in the utility plants, turbines are inspected within 12 months after going into service, and then after every 10,000 operating hours. If a turbine is not in daily service it may be well to keep the interval between inspections at 10,000 operating hours, but not let total elapsed time exceed three years.

Who Makes Inspections? Some industrial plants have maintenance men they feel are competent to inspect and overhaul their turbines, but most concerns find it more satisfactory to employ the manufacturer's field engineers to supervise this work. The latter practice is highly recommended because the service engineer is factory trained and kept advised of new developments, and is in constant touch with the equipment designers.

Most industrial insurance companies have inspectors in the field, primarily for their own protection. When contemplating an inspection notify the insurance company so their inspector may make his own observations.

RECORD KEEPING

Turbine inspectors should have a thorough procedure for systematic checking and recording of wear, erosion, gradual deterioration and functioning of governors and safety devices. References at the end of this article cover various phases of turbine inspection and overhaul.

Condition of all wearing parts of a turbine should be listed in the inspection report. Photographs, sketches or templates may supplement this information. Comparison of these data for succeeding inspections will enable predicting when parts should be replaced and preventing failure in service.

Copies of inspectors' reports should be in the files of both user and manufacturer so that the life history of the unit is readily available to the parties principally interested.

Operating Records. By properly logging certain readings hourly the operator effectively "takes the pulse of the machine."

Stage-pressure records indicate where scale accumulates in the turbine steam path. A suddenly increased stage pressure usually results from a foreign object passing through the turbine and denting or restricting the nozzles and buckets. A gradually increasing stage pressure is usually caused by scale deposits. When stage pressures plotted against steam flow show an increase of 10%, it is time to do something about it.

If deposits are soluble in water, the