

# PROTECTIVE SYSTEM—ELECTROHYDRAULIC CONTROL

## BASIC FUNCTIONS

### GENERAL

The purpose of the protection system is to detect undesirable or dangerous operating conditions of the turbine generator and to take appropriate trip action automatically while informing the operator on the detected condition and the following action.

The principal signal flow of this system is shown in Figure 1.

The two major groups of components of the protection system are:

1. The Mechanical Hydraulic Trip System. This portion of the system is described in detail in the Electrohydraulic Control Section of the instruction book.
2. The Electrical Alarm and Trip System. This portion of the system is described in detail in the Electrohydraulic Control Section of the instruction book.

### PRINCIPLES OF OPERATION

During normal operation, the emergency trip fluid system (ETS) is pressurized from the high pressure (HP) hydraulic fluid supply. This makes it possible to open all turbine valves by the presence of opening signals or the absence of closing signals from the electrohydraulic control. (EHC)

Any trip action of the protection system will ultimately remove the fluid pressure from ETS which will trip the main and reheat stop valves directly, the control and intercept valves through the relay trip valve and the extraction check valves through the air relay dump valve.

The MECHANICAL TRIP VALVE normally admits fluid pressure to the lockout valve. It can be tripped by

- the overspeed trip,
- the manual mechanical trip and
- the mechanical trip solenoid (when energized by the master trip relay or the trip button).

This will remove the pressure to the lockout valve.

The LOCKOUT VALVE will bypass the action of the mechanical trip valve when its solenoid is energized during testing of the overspeed trip. Actuation of either the manual mechanical trip, the mechanical trip solenoid or the backup overspeed trip will de-energize the lockout valve, thereby making the mechanical trip valve effective again.

The lockout valve admits its output pressure to the master trip solenoid valve.

The MASTER TRIP SOLENOID VALVE admits the lockout valve output pressure to the EMERGENCY TRIP SYSTEM (ETS), if either one or both of its pilot solenoid valves are energized with 24 v d-c through a normally closed contact of the master trip relay. De-energizing both pilot solenoid valves simultaneously will remove the ETS pressure. A test switch is provided to test one solenoid pilot valve at a time for proper operation.

The MASTER TRIP RELAY is de-energized during normal operation. Any number of trip signals of the electrical trip system will energize the master trip relay and initiate the following redundant trip action, of which each one will remove the ETS pressure independently:

1. DE-ENERGIZE both pilot solenoids of the master trip solenoid valve,
2. ENERGIZE the mechanical trip solenoid and
3. LOCK the master trip relay in energized position until all trip signals are cleared and the reset push button is depressed.

Loss of the ETS pressure will, through the EMERGENCY TRIP PRESSURE SWITCHES, lock the master trip relay in energized position until the reset push button is pushed and the ETS pressure has been re-established (two pressure switches in series are used to prevent accidental trip on failure of one pressure switch). The same signal from these pressure switches will also lock the speed reference in "VALVES CLOSED" position and limit all servo-amplifier outputs substantially to zero until the ETS pressure has been re-established.

Depressing the TRIP BUTTON on the turbine panel will energize the master trip relay and the mechanical trip solenoid directly.



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Depressing the RESET BUTTON on the turbine panel will:

1. break the lock-in circuits,
2. reset the VACUUM TRIP CIRCUIT (even if vacuum is below 20-in. Hg) and
3. reset the mechanical trip valve.

The reset button must be held down until the "RESET" light on the panel comes on to assure

that the ETS pressure has been re-established before releasing the button.

The OVERSPEED TRIP TEST provisions are used to test the overspeed trip device and the mechanical trip valve action while operating at about rated speed and at load if desired. The logic system is built to provide flexibility while keeping the possibility of misoperation to a minimum.

ALARM contacts for the purchasers alarm system and indicating lights on the turbine control panel are provided in the electrical system.



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