

TESTING OF THE OVERSPEED TRIP SYSTEM

See ELECTRICAL TRIP AND ALARM SYSTEM, PROTECTIVE CIRCUITS, for functional description.

SEE TABLE I FOR:

- Test designation
- Devices tested
- Schedule
- Test conditions
- Test procedure
- Indications

In Table I, it is assumed that all tests are successful and without any complications.

THE FOLLOWING DESCRIPTION COVERS POINTS OF SPECIAL INTEREST AND INSTRUCTIONS FOR MOST LIKELY OCCURRING ABNORMAL BEHAVIOURS OF THE SYSTEM.

IN ALL CASES OF MALFUNCTION, THE OPERATOR MUST MAKE HIS DECISIONS WITH A THOROUGH KNOWLEDGE OF THE SYSTEM AND ACT IN THE BEST INTEREST FOR SAFE OPERATION BUT WITHOUT UNNECESSARY LOSS OF GENERATION.

OVERSPEEDING

All tests that call for overspeeding of the unit (Tests B, C and E) must be conducted with a THOROUGHLY WARMED-UP TURBINE AND GENERATOR ROTOR.

On a cold or warm startup, Tests A and D should be made and after they are successfully completed, the unit should be synchronized and run at initial or higher load for several hours before it is taken off the line to conduct overspeed tests. It is essential that the ROTOR BORES have reached STEADY-STATE TEMPERATURE conditions BEFORE OVERSPEEDING the unit.

In Table I this is indicated under the test conditions as "ROTOR HOT."

TESTS

TEST A

Test A is a routine functional test of the overspeed trip device and the mechanical trip valve.

The AND/OR statement under schedule in Table I is to be interpreted as: If the unit is started weekly or more often, the on line "Once a Week" test can be omitted.

This test "exercises" the overspeed trip and the mechanical trip valve and is, therefore, useful to keep these devices operable and to prevent an excessive rise of the trip speed.

Although the test can be performed at any load, including full load, it is, for psychological reasons preferred to do it at low load.

Together with the closing test of all steam valves this constitutes a complete test of all parts of the overspeed trip system except the relay trip valve.

UNSUCCESSFUL TEST A

If in Test A the mechanical trip valve should fail to trip, the solenoid oil trip valve should be observed. If this valve seems to work, it must be concluded that the overspeed trip device is sticking. In this case the BACKUP OVERSPEED TRIP CIRCUITS should be tested immediately (Test D). If Test D is successful, the unit can be left on the line up to 24 hours. As soon as convenient within this period, the following procedure should be used:

1. Unload the unit completely
2. Open circuit breaker
3. Push "LOCKOUT"
4. Push "MEDIUM" startup rate
5. Push "OIL TRIP" AND "OVERSPEED" simultaneously.
6. If the mechanical trip valve trips below 110 percent speed, return to rated speed, reset and conduct Test B (this time without pushing the oil trip).

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If the trip speed in Test B is within the tolerances (see Diagram of Control Mechanism, Tab 4 of Mechanical Instruction Book) the unit can be returned to service.

7. If the overspeed trip device fails to trip at 110 percent speed with oil trip on or is above tolerance in Test B the unit **MUST BE SHUT DOWN IMMEDIATELY** and the overspeed trip must be repaired to pass Test A and B or C.

If, following an **UNSUCCESSFUL TEST A, TEST D IS ALSO UNSUCCESSFUL, THE UNIT MUST BE SHUT DOWN IMMEDIATELY AND THE DEFECTIVE DEVICES AND CIRCUITS MUST BE REPAIRED.**

TEST B

Test B is a preferred test to establish the exact trip speed after the system test (C) has been successful but the trip speed was readjusted or a confirmation on the trip speed value is desired (every 6 to 12 months).

During this test the speed control system is not affected and when the "OVERSPEED" button is released the unit will return to rated speed automatically.

Since after this test resetting of the mechanical trip valve above approximately 102 percent is not possible and there is a risk of mechanical damage on the trip mechanism if the reset is attempted above 102 percent speed, it is recommended to wait until the unit is again controlling at rated speed before the mechanical trip valve is reset.

This test can also be used to take data for the speed regulation of the control valves and the intercept valves. If this is desired, the vacuum should be very good and the excitation of the generator should be removed in order to have the unit coast down as slowly as possible so that the valve opening is much slower than the built in opening rate limit.

UNSUCCESSFUL TEST B

Sticking of the overspeed trip device or the mechanical trip valve would be uncovered by Test A, rather than Test B.

If, in Test B, the trip occurs too low the unit can be returned to service; however, the operator must realize that the unit will likely trip out on overspeed if full load should be lost.

IF THE TRIP SPEED IS ABOVE TOLERANCE OR THE TRIP DOES NOT OCCUR, THE UNIT MUST BE SHUT DOWN IMMEDIATELY TO REPAIR THE DEFECTIVE MECHANISM.

TEST C

Test C is the ultimate system test that should be conducted after installation or maintenance on the system in order to verify the proper functioning of the system after all partial checks have been satisfactory.

This test can replace Test B if it is conducted every 6 to 12 months; however, more frequent application of Test C is not recommended because the fast closing of the valves represents heavy duty.

Special care should be used when resetting (with master reset). The speed should not be above 102 percent. It is best to wait until the unit has coasted down to rated speed before resetting.

Since all valves trip closed and the speed set returns to "VALVES CLOSED," the unit will keep decelerating until the emergency trip system is reset and the speed selection rated speed is made by pushing the corresponding button. It is desirable to select the "FAST" startup rate in order to minimize the delay in valve opening.

UNSUCCESSFUL TEST C

In case the trip speed is not within tolerances, consult Test B.

If any turbine valve did not close fast or the speed set did not return to "VALVES CLOSED" or the emergency trip system did not "seal in" in tripped position, the unit should be shut down and the defective portion of the system should be repaired.

Except for obtaining the trip speed, the system operation can equally well be tested with the manual trip at the front standard or the MASTER TRIP button. During initial startup, these tests should precede Test C preferably without steam pressure in the boiler and, therefore, at standstill.

TEST D

Test D is a circuit test for the backup overspeed trip.

Since the backup overspeed trip (BUOT) actuates the master trip relay by energizing a circuit (at approximately 112 percent speed), the circuits can be tested by opening the trip circuit of the BUOT and lowering its speed reference just below rated speed temporarily. This is all done automatically when the "BACKUP OVERSPEED TRIP TEST" button on the monitor panel is depressed.

A successful test will result in lighting the "BUOT" light on the monitor panel.



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TABLE I

TEST DESIGNATION	DEVICES TESTED	SCHEDULE	TEST CONDITIONS	TEST PROCEDURE	INDICATIONS
A	Overspeed trip Mechanical trip valve (MTV) (Steam valves remain open)	Once a week and/or at each startup	Rated speed on line As soon as rated speed is reached, off line	<ol style="list-style-type: none"> 1. Push "LOCKOUT" 2. Push "OIL TRIP" until MTV trips (a few seconds) 3. Push "RESET" until MTV is reset (a few seconds) 4. Lockout - "NORMAL" automatic (approximately 10 seconds) 	<p>"LOCKOUT" light on MTV "TRIPPED" light on</p> <p>MTV "RESETTING" light off - on - off "RESET" light on</p> <p>"NORMAL" light on "LOCKOUT" light off</p>
B	Overspeed trip (trip speed) Mechanical trip valve (MTV) (steam valves remain open)	6 to 12 months	Off line ROTOR HOT OVERSPEED For trip speed tolerances see diagram of control mechanism in Tab 4 of mechanical volume of instruction book	<ol style="list-style-type: none"> 1. Push "LOCKOUT" 2. Push "FAST" startup rate 3. Push "OVERSPEED" and keep depressed 4. At 50 rpm below trip speed push "MEDIUM" startup rate Keep "OVERSPEED" depressed 5. At trip speed Record trip speed Release "OVERSPEED" 6. Let unit slow down to rated speed it will hold speed there. 7. Push "RESET" (not master reset) 8. Lockout - "NORMAL" automatic (approximately 10 seconds) 	<p>"LOCKOUT" light on "FAST" light on</p> <p>"OVERSPEED" and "ACCELERATING" light on</p> <p>"MEDIUM" light on (5 percent/minute rate)</p> <p>MTV "TRIPPED" light on</p> <p>"AT SPEED" light on rated speed on speed Indicator</p> <p>MTV "RESETTING" light off - on - off "RESET" light on</p> <p>"NORMAL" light on "LOCKOUT" light off</p>
C	Overspeed trip system (trip speed) All steam valves	At startup after main- tenance work on trip system or valves.	Off line Rotor hot Overspeed For trip speed tolerances see diagram of control mechanism	<ol style="list-style-type: none"> 1. Push "FAST" startup rate 2. Push "OVERSPEED" and keep depressed 3. At 50 rpm below rated trip speed push "MEDIUM" startup rate Keep "OVERSPEED" depressed 4. At trip speed Record trip speed Release "OVERSPEED" Check valve closures 5. Let unit slow down to rated speed or less 6. Push "MASTER RESET" until ETS "RESET" light comes on 7. Push RATED TRIP SPEED 8. Push "FAST" startup rate 9. Let unit accelerate to rated speed 	<p>"FAST" light on</p> <p>"OVERSPEED" and "ACCELERATING" light on</p> <p>"MEDIUM" light on (5 percent/minute rate)</p> <p>MTV "TRIPPED" light on ETS "TRIPPED" light on Speed set "VALVES CLOSED" on</p> <p>Rated speed</p> <p>MTV "RESETTING" off - on - off MTV "RESET" on ETS "RESET" on</p> <p>Rated speed set light on "ACCELERATING" light on</p> <p>"FAST" light on</p> <p>"AT SPEED" light on rated speed on speed indicator</p>
D	Backup overspeed trip (BUOT) circuits	Once a week and after each startup	Rated speed on line (or off line if desired)	<ol style="list-style-type: none"> 1. Push "BUOT TEST" on monitor panel. Keep depressed for a few seconds. 	<p>"BUOT TEST" light on (indicates test successful)</p>
E	Backup overspeed trip system (trip speed) All steam valves	12 to 24 months	Off line Rotor hot Load set at 40 percent* OVERSPEED *Load set must be increased because "OVERSPEED" top limit is generally set below trip speed of BUOT. For value of trip speed see Lineup Diag. or BUOT Schematic.	<ol style="list-style-type: none"> 1. Push loading rate "10" 2. Put load set to 40 percent (push "INCREASE" long enough) 3. Push "FAST" startup rate 4. Push "LOCKOUT" 5. Push "OVERSPEED" and keep depressed 6. At trip speed of mechanical overspeed trip: keep "OVERSPEED" depressed 7. At trip speed of BUOT Release "OVERSPEED" Record trip speed Check valve closure 8. Same as 5 through 9 of test "C". 	<p>"10" percent/minute light on</p> <p>Load set 40 percent, unit will accelerate approximately 4 percent in 4 minutes</p> <p>"FAST" light on</p> <p>"LOCKOUT" light on</p> <p>"OVERSPEED" and "ACCELERATING" light on</p> <p>Mechanical trip valve "TRIPPED" light on</p> <p>"LOCKOUT" light off MTV light "TRIPPED" ETS light "TRIPPED" Speed set "VALVES CLOSED" Load set running back to zero.</p>



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Releasing the test button will restore the circuits to normal operation within about 5 seconds.

Test A must not be conducted simultaneously with Test D.

UNSUCCESSFUL TEST D

If the "BUOT" light does not come on, check speed setting.

If an attempt to correct the speed setting is unsuccessful, the unit can be KEPT OPERATING AT ANY LOAD BUT, TESTS INVOLVING THE LOCKOUT (A, B and E) MUST NOT BE PERFORMED under these conditions.

If the backup overspeed sensing circuit or the relay appears to be inoperative, the corresponding circuit card can be replaced with a preset spare.

TEST E

Test E is the BACKUP OVERSPEED TRIP SYSTEM TEST.

This test should be performed after initial startup and at 12 to 24 months intervals thereafter.

More frequent application of this test is not advisable because of the high overspeed and the heavy valve duty involved.

Test D and a reading on the backup overspeed reference voltage should always precede this test.

The same precautions for resetting as in Test C are applicable.

If the test is not successful, all tests involving the "LOCKOUT" should be omitted until the defective parts of the system have been repaired.

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