
Trouble shooting of Steam Turbine

Instruction Manual

TOSHIBA ENERGY SYSTEM & SOLUTION CORPORATION

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1. Introduction

This manual is provided to ensure the safe handling of the Steam Turbine Control Equipment. Before operation and maintenance, be certain to read this manual and fully understand the contents to have proper, sufficient knowledge for operation and maintenance. This manual should be kept in the maintenance area and near the equipment so it can be easily referenced.

2. Precautions for Safety

Signs and messages in this manual and on the equipment body are important for management, operation, maintenance and inspection. They are provided to avoid possible injuries and/or damages as well as to ensure the correct handling of the equipment and/or working fluid. The following signs, symbols and short messages should thoroughly be understood before reading this manual and also before working. It is advised that you also read the instruction manuals of related equipment and components.

IMPORTANT MESSAGES

Read this manual and follow its instructions. Signal words such as DANGER, WARNING, two kinds of CAUTION, and NOTE, will be followed by important safety information that must be carefully reviewed.

 DANGER	Indicates an imminently hazardous situation, which will result in death or serious injury if you do not follow instructions.
 WARNING	Indicates an imminently hazardous situation, which could result in death or serious injury if you do not follow instructions.
 CAUTION	Indicates an imminently hazardous situation, which if not avoided, may result in minor injury or moderate injury.
CAUTION	Indicates an imminently hazardous situation, which if not avoided, may result in property damage.
NOTE	Give you helpful information.

APPLICATION

This document is provided for maintenance of Steam Turbine Control Equipment. Never use this for other purposes.

WARRANTY AND LIMITATION OF LIABILITY

TOSHIBA ESS Corporation has no obligation to compensate for any damages, including collateral damages, caused by abnormal conditions or failures of this equipment and connected devices.

QUALIFIED OPERATORS ONLY

This instruction manual is written for chief engineers of your company and/or competent persons authorized by the chief engineers (*).

For operation, maintenance and inspection, this instruction manual and other manuals of the associated devices and components shall be read and understood. Workers shall follow the directions of the chief engineers.

* Authorized person means engineers who have educated according to the program offered by **TOSHIBA ESS Corporation**.

WARNING LABEL

- (1) To ensure safety, all the warning labels shall be read and understood
- (2) Warning labels shall be kept in such a condition that they can be easily seen. They shall never be contaminated, removed or blocked from view by cover.

▲ WARNING

- When you do measurement or inspection at local place, please don't touch coupling, rod and stem under operation because of a sudden movement of steam valves.
- Electro-Hydraulic Controller Oil (EHC oil) is much high pressure at the normal operating condition, so please Do NOT touch the instruments attached to hydraulic actuators under operation, except by qualified persons.
- When you go up to a height for measurement or inspection, please use a safety belt to prevent to fall.
- Be careful not to touch a hot part to prevent a burn.
- . Be careful of sudden oil leakage from pressure components.
- . At the time of valve test, steam leak happens. So please don't go to near to prevent a burn.
- . If you do measurement at local directly, be careful not to touch a hot part to prevent a burn.
- When you do measurement or inspection at local place, be careful not to slip by oil that leaked or come out.
- A worker should take out some things, for example pencils etc., from a pocket beforehand not to drop into an oil tank by careless miss.

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3. General

Generally, troubles taking place in the control equipment and devices are not detected until after operation is crippled in one form or another. However, troubles should be prevented in advance by detecting their symptoms of trouble in the equipment and devices in operation before such undesired condition may be observed. For this purpose, periodical tests and routine inspections of control equipment and devices are recommended.

Most of troubles can be detected and prevented by periodical tests and routine inspection, and it is essential to know and understand the meanings of results and findings to be obtained through such periodic tests and inspection.

Described in paragraph 4 "Trouble shooting" are typical or common situation of troubles that may happen in the control equipment and devices during operation.

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4. Trouble shooting

4.1 Main Turbine Steam Valve

⚠ WARNING	
■ When you do measurement or inspection at local place, please do NOT touch coupling, rod and stem under operation because a sudden movement of steam valves may injure you.	
■ Electro-Hydraulic Controller Oil (EHC oil) is much high pressure in operation, so please do NOT touch the instruments attached to hydraulic actuators under operation, except by qualified persons.	
■ When you go up to a height for measurement or inspection, please use a safety belt to prevent to fall.	
■ Be careful not to touch a hot part to prevent a burn.	

Table 0 (Main Turbine Steam Valve)

Symptoms	Causes	Judgment and action
1. Actual load does not follow the signals of varying load setting (under valve throttle operation) or load changes abruptly.	1) Sticking of steam valve or breakage of steam valve 2) Insufficient output of the servomotor due to oil leakage 3) Improper adjustment of load limiter 4) Malfunction of the revolution detector	1) Measure stem lift and steam flow rate in reference to lift signal, and if the measurement differ greatly from the specified value, overhaul and repair. ■ . Be careful not to touch a hot part to prevent a burn. 2) Inspection form outside. ■ . Be careful of sudden much oil leakage. 3) Check and Confirm static characteristics. 4) Overhaul and inspect.

Symptoms	Causes	Judgment and action
(1. Cont.)	5) Defect in turbine characteristics	5) Carefully study the operation records.
2. Improper stability under no load	1) Defect in speed detector 2) Changes in speed regulation rate 3) Changes in flow rate characteristics of the control valve	1) Overhaul and inspect. 2) Test and confirm speed regulation rate. 3) Measure flow rate characteristics of control valve.
3. Overspeed tripping takes place at load rejections or tripping	1) Leakage through steam valve is increased too much. 2) Slow closing speed of steam valve 3) Valve friction is increased	1) Effect leak test, and if necessary perform fitting or replace parts. 2) Measure valve closing speed by use of an oscilloscope. 3) Check valve closing or opening time during valve test and compare with previous records. If it is detected tendency toward longer valve or steam are needed to maintain.
4. Micro-vibration of steam valve	1) Effects of vibration of the steam pipe 2) Vibration of the steam valve due to its shifting	<p>1) Measure natural vibration of the steam pipe.</p> <p>WARNING</p> <p>■ . At the time of valve test, steam leak happens. So please don't go to near to prevent a burn.</p> <p>2) Overhaul and inspect the valve if vibration acceleration is above the tolerance.</p> <p>WARNING</p> <p>■ . If you do measurement at local directly, be careful not to touch a hot part to prevent a burn.</p>

4.2 Main Lube Oil System

WARNING

- When you do measurement or inspection at local place, be careful not to slip by oil that leaked or come out.
- A worker should take out the things inside of pockets, for example pencils etc., before access to the Lube oil tank and/or openings to be able to access to the Lube Oil System component, to prevent foreign materials drops into an Lube oil tank by careless miss.

Table 1 (Main Turbine Lube. Oil System)

Symptoms	Causes	Judgment and action
1. Bearing oil pressure does not reach to normal operating pressure.	1) Main Oil strainer (filter) element is clogged. 2) Oil pump suction strainer is clogged.	1) Clean or replace the strainer (filter) element. 2) Clean the strainer element.
2. Unstable Oil pressure	1) Oil pump is air bound . 2) Leakage of oil.	1) Check the oil level in Main Oil Tank. 2) Visually inspected from outside.
3. Pump noise increase	1) Pump is going to be unbalanced condition. 2) Wear of Bearings.	1) Check the impeller and shaft of oil pump. (run-out, unbalance of shaft) 2) Check the all bearings of the oil pump.
4. Excess oil mist from Main Oil Tank or Vapor Extraction line.	1) Incorrect tank inside pressure.	1) Check the pressure (vacuum) inside the Main Oil Tank. 2) Check the operation condition of vapor extractor.

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Revision History (for internal use)

REV.	REV. ISSUED	CHANGED PLACE AND CONTENT		APPROVED BY	REVIEWED BY	PREPARED BY
		PAGE				
a	'06-9-28		1st edition - XBME Ref : EKT100413 / EKT100434	T.Ohfuji '06-9-27	H.Hosaka '06-9-27	T.Endo '06-9-27
b	'19-9-25		社名変更 DRS-A014606	R. Takemaru Sep.25, 2019	I.Tsutsui Sep.25, 2019	Y.Tanaka Sep.20, 2019