General Description for Special Condition Turbine Operation

Instruction Manual

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TOSHIBA ENERGY SYSTEMS & SOLUTIONS CORPORATION

Table of Contents

1. Introduction

This manual is written to ensure safe handling of the Special Condition Turbine. Before maintenance, be certain to read this manual for proper use of the equipment. This manual should be kept near the equipment so it can be readily 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 given to avoid possible injuries and damages as well as to ensure correct handling of the equipment. The following signs and short messages should thoroughly be understood before reading this manual. 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 equipment is designed for maintenance of special condition turbine. Never use this for other purposes.

WARRANTY AND LIMITATION OF LIABILITY

Toshiba 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 electric engineers of your company and competent persons authorized by the chief electric 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 electric engineers.

* Authorized people mean electric engineers who have received education offered by Toshiba.

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.

NOTE
■ This method of turning operation should be done only during an emergency, and should not be performed unnecessarily.

3. Turning Operation

Turning operation refers to the continuous or intermittent low-speed operation of the turbine rotor system, auxiliaries, and equipment, including the turning unit and its auxiliaries. The turning device consists of a turning motor as a driver and a train of reduction gears. The last reduction gear is a gear wheel fixed to the rotor, which rotates the rotor. The turning speed is controlled by reduction ratio for the gear train and is the speed most suitable to establish stable turning operation and oil film thickness.

Proper turning operation for the turning unit is dependent on the lubricating system. It is therefore important that the operator understand the necessity of oil pump management for supplying lubricating oil to the turning system.

The purposes for turning operation vary with the condition of the unit for different occasions. Some of the conditions and operating methods are described in this section.

3.1 Turning Operation before Turbine Startup

To prevent abnormal vibration during turbine startup, especially while increasing speed, the rotor eccentricity must be stable and within normal values.

Generally, after the unit trip, there is an unavoidable difference in temperature between the upper and lower halves inside the casing, with or without turning operation. During suspended turning operation, the rotor bends because of a deformation generated by this temperature difference within the limit of elasticity. The primary purpose of turning operation prior to turbine startup is to prevent or correct this bending.

Normally, the front shaft on the front side of the rotor has an eccentricity detecting terminal which allows the operator to monitor bending of the rotor by watching the value on the eccentricity meter. The procedure for monitoring eccentricity is referred to in EKS101339 “Turbine Operation”.

Recommended turning operation as preparation for startup of an ordinary unit is listed below.

Maximum temperature of casing	**Recommended operation hours**
Below 180 °C	8 hours
Above 180 °C, Below 350 °C	6 hours
Above 350 °C	4 hours

These recommendations for turning operation are based on turbine casing temperature and on the conditions during interruption of turning. Minimum recommended turning operation is 4 hours.

The maximum temperature of casing means the maximum temperature in each casing corresponding to the rotor system. Normally, this is the temperature of the first-stage shell and reheat bowl inner surface.

The values above represent the amount of bending of the rotor based on the inner surface temperature of the casing, showing the hours generally required for correcting the bending. Therefore, monitoring the eccentric value is extremely important.

3.2 Turning Operation at Turbine Start

When steam is admitted to the turbine, the rotor automatically parts from the turning unit, and the speed increases continuously from the turning speed. Lubrication of the bearing at this time shifts smoothly from boundary lubrication to fluid lubrication. This is another purpose of the turning operation during turbine start.

If rotor speed increases because of steam only, without turning operation, it may damage the bearing and rotor because the static friction will shift to dynamic friction between the inner surface of the bearing and journal.

Turning operation stops at the stopping of the turning motor, when it has been confirmed that the rotor is away from the turning unit, and at the start of the turbine.

3.3 Turning Operation at Turbine Shutdown

The purpose of continuing the turning operation at the time of stopping the turbine is to minimize deformation of the rotor and casing and to cool them uniformly. Conspicuous deformation of the rotor may cause contact between the stationary part and the rotating part, with resulting damage. The turning operation tends to make the temperature distribution inside the turbine shell and on the rotor more uniform. However, it should be noted that some temperature difference between the upper and lower casing is unavoidable.

On the other hand, because of the construction of the turbine, the bearing bottom side is the contact part between the stationary and the rotating part. When the turbine stops at a high temperature, the heat is conducted in the axial direction of the rotor from the bearing surface to the stationary part. Oil circulation is necessary to prevent the temperature of the bearing metal from rising.

Turning operation at turbine stop is based on when the turning unit and/or oil pump should be stopped. Stopping of a turning operation may be considered as follows, with the maximum temperature of the inner surface metal of the casing corresponding to the rotor system as the standard.

Stopping of turning unit ...... under 250 °C
Stopping of oil pump........... under 250 °C

These are the minimum operating temperature conditions for normal stopping procedure. Turning operation should continue as appropriate down to lower temperature or to the next turbine starting, if the turbine is being stopped for only a short period.

3.4 Long-Term Turbine Shutdown

When long-term turbine shutdown of 2 weeks to several months is scheduled, the turning system should be maintained according to the following:

(1) Once a week, the oil pump should be operated for about one hour to renew oil in the system. During that hour, the turning gear should be operated about 10 minutes continuously to renew the oil film in the bearings.

(2) Instructions for operation of lubricating system auxiliaries should be exactly followed for each item of equipment.

(3) For long-term turbine shutdown, the orientation of the poles of the generator should be set vertically. At each subsequent turning operation stopping point, the pole orientation should be alternated between top and bottom settings.

4. Turning Operation Precautions

4.1 Oil Pump

Before starting on turning operation, each bearing must be supplied with lubricating oil. Normally, an interlock prevents the turning motor from operating unless the bearing oil pressure reaches a specified value.

4.2 Steam Seal System

When the steam seal system is operating, turning operation should be carried out to prevent the bending of the rotor due to heating from the gland steam. However, if there is little possibility of rotor bending, turning operation is not always necessary as long as the turbine is not going to be started.

When reviving the steam seal system without carrying out a turning operation, the gland steam temperature should be limited to less than 250 °C. In this case, the oil pump must be operated continuously.

During long-term operation with the above condition, the rotor should be rotated 180 degrees once a week. If the gland steam temperature is over 250 °C but under 300 °C, 180 degrees rotation of the rotor once a day is necessary.

4.3 Bearing Feed Oil Temperature

During continuous turning operation, since each bearing is in the state of boundary lubrication, it is better to keep feed oil temperature lower, so long as the oil pump is not overloaded. However, before starting the turbine, oil feed temperature should be 27 °C - 37 °C.

These limits are provided in "Lubricating System" of “Turbine Operation Limits”.

These are also recommended oil temperature ranges for turning unit start after turbine shutdown. However, if the temperature is over the recommended range but within the upper limit, turning operation may be started if the temperature will be in the recommended range within 15 minutes. If temperature is higher than this range, an allowance may be made, but varies with unit and bearing and also changes with time. The temperature should be maintained within the limit.

If allowable limit values are specifically shown for the unit concerned, to protect the bearing, turning operation should not be carried out until the temperature is within the limit.

4.4 Bearing Metal Temperature

For a unit where bearing metal temperature is measured, more direct monitoring of the bearing metal is possible.

The bearing metal temperature should be nearly equal to the feed oil temperature before starting turning operation. The metal temperature should be the same level as that of the oil, with the oil pump operating normally.

5. Interruption of Turning Operation

When the turning operation is resumed after having been interrupted for short periods, it should be extended for a period 10 times as long as the period for which is was stopped. The eccentricity value should be closely monitored during this period.

When turning operation is suspended for balance adjustment, the turning unit can be stopped anytime, as long as the turning gear oil pump is operating. However, the turbine metal should be cooled as long as possible during the time the turbine is being stopped. After the turbine has slowed down to a speed at which the turning operation can be started, a one-hour minimum turning operation is required for uniform temperature distribution of the turbine rotor before work should proceed.

Turning operation should not be suspended longer than 30 minutes. In case the work cannot be finished within 30 minutes, it should be scheduled for two or more separate sessions.

To resume turning operation after the work has been finished when the suspension is shorter than three hours, the rotor should be rotated a half turn, held for a period of about one-third as long as suspension period, and then operated continuously. When the suspension is longer than three hours, the rotor should be rotated a half turn and held for one hour. After that, the rotor should be rotated a half turn again and held for twenty minutes, and then operated continuously. Turning operation must be done for ten minutes minimum before work is continued.

This approach is effective in quickly minimizing eccentricity caused by a rotor bent as a result of suspended turning operation.

After the suspension for the rotor balancing adjustments, turning operation should be continued for a four-hour minimum regardless of the suspension period.

This turning operation minimizes the temporary rotor bowing, checks the effect of the rotor balancing, and should take place before the turbine startup conditions discussed in Section 3.1.

6. Emergency Turning Operation

It is impossible here to address turning operation for all emergency conditions. However, typical situations and general turning operation methods are described and examples provided in the following subsections.

6.1 Turbine Trip Caused by High Shaft Vibration

When the turbine is tripped during normal operation because of high shaft vibration resulting from heavy rubbing or similar abnormal conditions, the cause must be investigated before the turning operation is continued. High vibration and turbine trip are caused only by a serious mechanical difficulty.

Smooth turning operation may be impossible when large deformation occurs at stationary and rotating parts as the result of heavy rubbing. In such a case, forced turning operation may increase the damage to the turbine inside. Therefore, when the vibration monitor indicates a clear rubbing pattern during turbine slow down, further turning operation should be determined based on the rubbing noise and vibration patterns. At the start of the turning operation, whether to have continuous operation should be determined on the basis of the electric current of the turning motor and the rubbing noise.

When the heavy vibration is not caused by rubbing, it may be caused by imbalance resulting from inner turbine damage or the abnormal conditions of the driven rotor system, including a coupling. In such cases, the vibration record chart and rubbing noises will often indicate whether turning operation should be continued. Generally, it is better not to continue the turning operation unless the cause is clear.

Normally, when vibration has been caused by rubbing, turning operation of four hours or more will correct temporary rotor bowing.

6.2 Bearing Damage

If it is suspected that bearing damage has resulted from an abnormal rise in bearing metal temperature or bearing oil drain temperature during normal operation, the unit should be tripped.

When the journal bearing has burnt out, changes often occur in the turbine slow down curve and the time required to drop speed. Therefore, this condition can be determined to some extent before opening and checking the bearing. If a unit has a recorder for bearing metal temperature, apparent differences from the normal condition may be observed during the turbine slow down.

When an abnormal condition is recognized during normal operation or slow down, the turning operation should be discontinued immediately. In such cases, turning operation may not only increase bearing damage but may also damage the turbine inside parts. A burnt out bearing may be identified by checking the oil sight and observing the clearance measurement of the oil deflectors after stopping the rotation.

If no abnormal operation is noted, turning operation should be carried out according to the description in Section 3.2. During this period, however, the bearing metal temperature or bearing oil drain temperature and oil drain should be carefully monitored. If any abnormality is detected, the turning operation should be stopped immediately.

When the turbine has tripped but no abnormal condition or very little damage has been recognized, the turning operation should follow standard procedures. However, at the next turbine start, areas around the bearing, including metal temperature and vibration recorder, should be carefully observed. It is important to observe bearing metal temperature to compare it with the normal value.

In units which measure bearing metal temperature, more accurate decisions about bearing damage may be available by comparing the measurements with the tendency of that at normal operation. For this purpose, the change tendency and level of bearing metal temperature are usually compared.

6.3 Turning Unit Problems

Some mechanical problems may make turning operation impossible immediately after the turbine has stopped. In such cases, it is not necessary to rotate the rotor immediately, but the operator should retry the turning after the temperature decreases.

Although some extent of rotor bowing may result from the suspension of turning, more serious damage may result from forced rotation during an emergency. Sufficient turning operation before starting generally eliminates the bowing effect.

When restarting the turning operation, operators should carefully check the internal contacts. If any abnormal signs are recognized, the normal turning operation should be suspended until the turbine temperature decreases.

For units with a manual turning crank (by an air motor), minimal turning will prevent temporary rotor bowing. As with all similar turning unit operations, it is important to operate the lubricating oil pump as long as possible.

6.4 Stopping of Lubrication Oil Cooling Water System

If the cooling water system for the bearing oil is stopped, turning operation and oil pump operation should be continued if possible. However, if the cooling water temperature and bearing feed oil temperature are likely to rise, it is better to stop circulation of cooling water, even if it is possible to operate the cooling water system.

In cases of turning unit restoration, after the unit has been restored it may be that turning operation is possible but the lubricating oil cooling water system is not yet operable. Especially after restoration it is important that turning operation be resumed as soon as possible to minimize the rotor temporary bowing and expedite normal operation. While in such a case the bearing feed oil temperature is likely not within the normal operating limit discussed in Section 6 and shown on Figures 6.1 and 6.2 of EKS101341 “Turbine Operating Limits”, it is recommended that the turning unit be operated using the following procedure as applicable.

(1) When the bearing feed oil temperature comes within +6 °C over the limits discussed in Section 6 and shown on Figures 6.1 and 6.2 of EKS101341 “Turbine Operating Limits”, the rotor should be started to turn by 180 degrees and the half turn continued every six hours.

(2) Turning operation should be continuous after the bearing feed oil temperature comes within the normal operating limit.

NOTE
■ This method of turning operation should be done only during an emergency, and should not be performed unnecessarily.

6.5 Stopping of The Oil Pump

As a rule, oil pump operation should not be stopped unless the conditions discussed in Section 3.3 have been satisfied. Continuous operation of the oil pump is a precondition of safe operation and stopping of the turning unit.

In the event of electric power failure, the loss of house AC emergency power, and limited DC power supply, the emergency oil pump should be operated for 15 minutes each hour.

Discontinued oil pump service in an emergency may cause heat damage to the babbitt metal of the bearings. If bearing metal thermocouples are installed, it is essential to monitor them. If the babbitt metal temperature exceeds 150 °C, an open inspection of bearing must be made before the turning operation is started.

When the turning operation is being restarted, bearing instruments should be observed to verify that they show values within the limits.

When the turning operation is suspended for maintenance, bearing feed oil pumping should be discontinued. Oil pump operation may be suspended following the recommendations below:

Maximum Casing temperature of permissible oil pump suspension	**Period**
Above 300 °C	10 minutes
Above 250 °C, Below 300 °C	30 minutes
Below 250 °C	Normal stopping is possible

7. Water Induction

Precautions must be taken for turning operation immediately following turbine trip caused by water induction into the turbine.

When heavy water has entered the turbine, the casing may become distorted, making turning operation impossible. In such a case, forced turning operation should be avoided to prevent further turbine damage. Immediately after the turbine trip the source of water must be located and eliminated, the turbine slowdown curve should be compared with the normal slowdown curve, and caution should be taken if abnormal vibration and noise are noticed. If any abnormality is recognized, the turbine should not be left on turning gear.

The turning operation should be started after drain of the water has been verified by temperature difference between upper and lower casing, by the behavior of the lower casing metal temperature, or by the temperature difference between upper and lower casing becoming within the limit.

If the turning motor experience a large starting electric current or if the turbine experiences unstable rotation or abnormal vibration and noise, turning operation must be stopped at once. It may also be necessary to suspend turning for several hours more until the casing metal temperature is uniform. When normal turning operation becomes possible, operation should be resumed following the procedure in Section 3.1.

In cases where water has entered the turbine during normal turning operation, the necessary steps should be taken to correct water induction. To prevent turbine inside damage and to eliminate the effect of water induction, turning operation must be stopped as fast as possible. When restarting the turning operation, the above mentioned procedures should be followed.

In case of a slight amount of water induction being indicated by the temperature difference between upper and lower casing and/or lower casing metal temperature, the original turning operation may be performed, assuming that the source of water has been located and eliminated.

8. Low-Speed Operation

Continuous low speed operation of the turbine should be avoided. At the time of startup, turbine speed maybe increased only after confirming that there is not abnormal rubbing in the bearings and between parts. The speed should be increased to 400 rpm and held up to 5 minutes. Only after confirming that there is no rubbing can speed be increased. If rubbing is suspected, the operator should trip the turbine at once and begin turning operation.

8.1 Speed Increase in Low-Speed Zone

During the period following rubbing check until the next low-speed heat soaking rpm, the speed can be increased, so long as no vibration is generated.

Between the speeds of 400 to 500 rpm's, the amount of vibration that is allowed to take place before activating the alarm or tripping mechanism is much less than the amount of vibration allowed in the higher speed zones. When an alarm does go off, the speed of the turbine should be held constant for up to 2 minutes. If the cause of the extreme vibration has not been taken care of within these 2 minutes, then tripping must be performed.

8.2 Low-Speed Heat Soak

Low-speed heat soak speed is 800 rpm, set to avoid the resonance frequency of the rotor. It is only at this speed and the rated speed that speed-holding is allowed during turbine operation. (See Section of “Turbine Operation”)

9. Overspeed Operation Cold Start Procedure

The starting and loading instructions require that after a cold start, the turbine should not be overspeeded until it has carried a 25 percent or greater amount of the rated load for at least three hours. Before that period the temperature of the metal at the turbine rotor core will be below the transition temperature as it is accelerated up to its operating speed.

In the past, a number of control system checks above the rated speed were generally recommended before synchronizing either a new turbine generator unit or an older unit following a major overhaul. These checks involved operation at speeds up to the overspeed trip speed, where the stress on the turbine rotor is approximately 25 percent greater than that at 100 percent rated speed. However, increased knowledge and understanding of rotor material behavior indicates that this practice is not desirable on cold turbines.

The alloy materials used in turbine rotors for high-temperature operations have a greater margin against stress from overspeed operation when the rotors are above their transition temperature of about 120 °C. The center of the rotor on a cold turbine will not reach 120 °C by the time the turbine is at rated speed. During acceleration and operation at rated speed, no load, the steam pressure in the turbine is low and the heat transferred to the rotor is not sufficient to adequately heat the rotor core above the transition temperature. Thus, it is not desirable to impose the added stress on the cold rotor by going to overspeed until all the metal in the rotor has been heated to 120 °C or higher. To raise the rotor core temperature to a level which can result in the transition to the more ductile condition, it is necessary to apply load to the unit for a period of time. Operation at 25 percent load for three hours will accomplish the desired heating.

The relatively cold unit must be synchronized following the half hour operation at rated speed and before any overspeeding. Then, after three hours of operation with at least 25 percent load, it will be necessary to remove load from the unit and complete the control system checks that are necessary at above rated speed, including calibration of the overspeed, backup overspeed trip, cutout governor, and speed governor.

The overspeed trip system should be tested and recorded prior to an inspection shutdown. If the overspeed trip point is satisfactory, the minimum turbine trip should occur at the same speed during the check before the unit is returned to service as recorded at shutdown.

10. Minimum Loading Recommendations

There is usually a minimum load point below which a turbine cannot be continuously operated without excessive heating of the exhaust hood structure and other latter-stage components. The heating is the result of rotational losses in the last stages which are greater at the lower steam flows associated with low-load operation.

The amount of heating which occurs depends on a number of variables such as inlet steam temperatures, the absolute pressure in the condenser, the load being carried by the turbine, and the configuration of the exhaust hood and condenser. Because of these variables, the minimum load on a particular turbine at which the exhaust hood will not overheat can best be determined by field experience.

The low-pressure stages of reheat turbines operate at higher temperature levels when running at low loads, because the reheat cycle introduces steam into the turbine at higher temperatures at a lower pressure level in the steam path. Water sprays are located at the exit side of the turbine last stage buckets to reduce or control the exhaust hood temperature on reheat turbines.

Moisture erosion of the buckets in the last few stages is increased by low-load operation. This is due to moisture from the water sprays being recirculated through the roots and out of the tips of the last-stage buckets and to inherent moisture in the steam which is dependent on the flow temperature characteristic of the boiler.

11. Low Load Operation Limits

The following limits should be placed on low load operation:

- The unit can be operated continuously at light loads when the exhaust hood temperature is 80°C or less, but the turbine is not available for rapid load increase. Because of the variables involved, the load point at which this temperature occurs is not exact, but is usually at no load.
- The unit is available for rapid load increase when the exhaust hood temperature is 52°C or less. This temperature occurs at about ten percent of rated load or considerably less with the use of water sprays.
- When the exhaust hood temperature is above 52 °C, the load should be increased slowly until the temperature falls below 52 °C, then may be increased in accordance with the regular procedure.
- Operation below five percent load should be held at a minimum because of increased moisture erosion of the latter-stage buckets.
- Motoring, revolving the turbine rotor in the opposite direction, of the unit is to be avoided or limited to short duration in emergency operation in order to prevent overheating the exhaust hood and moisture erosion of the buckets. Even in an emergency, motoring should be minimized. Motoring for more than 90 seconds in not permissible.

12. Operating Limitations with Feedwater Heaters Removed from Service

Assuming that the throttle steam flow is not changed, the following will occur when a feedwater heater is removed from service.

1. If the highest pressure heater is removed from service, the kilowatt output will increase. This occurs because the steam which was formerly extracted now passes through the turbine to the condenser. Thus, it will be necessary to reduce the control valve position, to maintain a constant kilowatt output, when the highest pressure heaters are removed from service.
2. When other than the highest pressure heater is removed from service, extraction to the next higher pressure heater will increase, because the feedwater temperature rise across that heater is greater than before. Turbine output capacity will decrease slightly.
3. Turbine and feedwater cycle efficiency will decrease when any feedwater heater is removed from service.

Conditions 1 and 2 will change the stage pressure drops and steam flow through the turbine, affecting the bucket, diaphragm, and thrust loadings.

These higher loading conditions can be determined and may be a consideration in the original turbine design. In this plant, feedwater heaters and bypass system is provided as following. (Figure 12.1).

Loading Condition A--One or more nonadjacent heaters may be removed from service, providing the steam flow is adjusted so that the name plate kilowatt rating is not exceeded.

Loading Condition B--If operation at nameplate kilowatts is desired when the adjacent heaters are removed from service, all the heaters at higher pressures must also be removed from service. The heaters must be removed from service in sequence, starting with the highest pressure heater, and proceeding in order to the lowest pressure heater to be removed from service. Similarly, when the heaters are returned to service, the lowest pressure heater must be placed in service first, then in proceeding order to the highest pressure heater. The steam flow must be adjusted so the kilowatt load does not exceed the name plate kilowatt rating.

Loading Condition C--The turbine may be operated with the highest pressure heater in service, and any combination of adjacent lower pressure heaters out of service, provided the steam flow is adjusted to facilitate at least a 10 percent load reduction from nameplate kilowatt rating for each additional adjacent heater removed from service. This is approximately a 10 percent load reduction for two adjacent heaters out of service, 20 percent for three adjacent heaters out of service, and so on. The maximum load reduction of 50 percent from nameplate kilowatt rating is usually sufficient to limit all bucket, diaphragm, and thrust loadings, at levels no greater than design, with normal heater operation. Vibration in the extraction stage will also be considerably reduced. Operation at higher than rated loads with the heaters out of service is always the owner's responsibility, because such operation encroaches upon design margins. This encroachment increases as additional feedwater heaters are removed from service. Harmful bucket, diaphragm, or thrust loadings may result from operation with feedwater heaters out of service except as described in Loading Conditions A, B, and C above.

HEATERS (Removed from service)	LOAD
A : —	—
B : 8, 7, 6	100 %
C : 4, 3	90 %
2, 1	90 %
4, 3, 2, 1	70 %

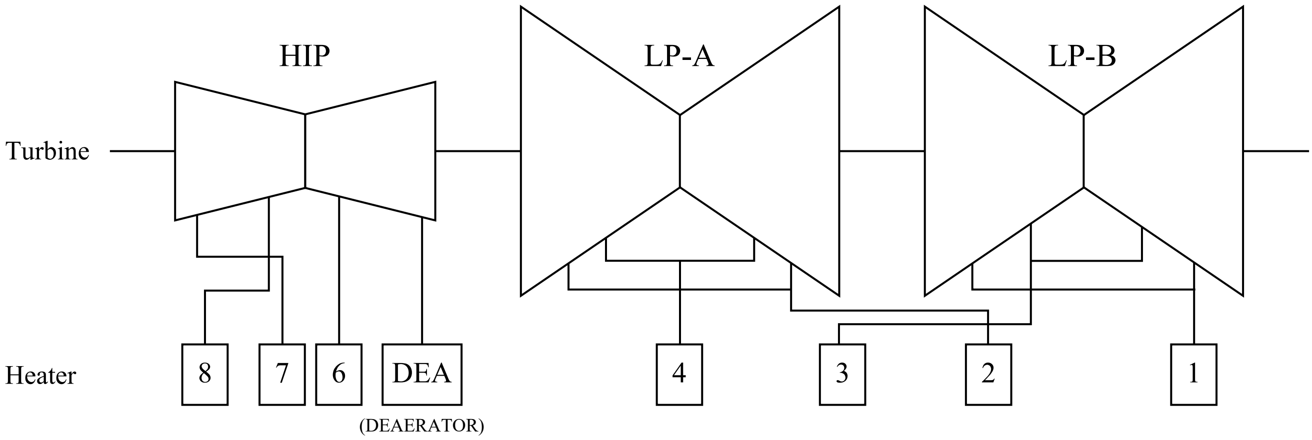

Figure 12.1

Revision History (for internal use)

REV.	REV. ISSUED	PAGE	CHANGED PLACE AND CONTENT	APPROVED BY	REVIEWED BY	PREPARED BY
a	19.Aug.’22	―	1st edition for XVVP1	K.Asai 19.Aug.’22	K.Asai 19.Aug.’22	M.Yamada 18.Aug.’22