(English Translation)

October 30, 2024

To whom it may concern,

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(Progress of Disclosed Matter)
Notice of Misconduct by a consolidated Subsidiary of the Company
(Measures to Prevent Recurrence of Misconduct at IHI Power Systems Co., Ltd.)

As IHI Corporation (hereinafter “IHI”) announced on April 24, 2024, IHI Power Systems Co., Ltd. (hereinafter "IHI Power Systems"), its consolidated subsidiary, was found to have recorded numerical values different from those measured during the test runs of marine engines and land-based engines (hereinafter referred to as "this matter"). In response, IHI commissioned a special investigation committee, chaired by Mr. Hiroshi Kimeda of Nishimura & Asahi (Gaikokuho Kyodo Jigyo), to conduct an independent review from the perspective of external experts.

IHI and IHI Power Systems have now received the investigation report from the special investigation committee and, based on the report, have formulated measures to prevent recurrence as IHI and IHI Power Systems.

IHI express its deepest apologies once again for the significant inconvenience and concern due to this misconduct to all stakeholders including our customers and related organizations. IHI group takes the root-cause analysis and recurrence prevention measures proposed by the special investigation committee seriously, and will earnestly strive to establish compliance adherence as a genuine corporate culture, working together to restore the trust of all stakeholders.

The impact of the Matter on the full-year consolidated earnings forecast is currently under review, and if any impact is expected, IHI will announce it immediately.

(END)

Attachments
October 30, 2024 “Investigation Report”

Report on Misconduct by IHI Power Systems Co., Ltd.

October 30, 2024

IHI Corporation
IHI Power Systems Co., Ltd.

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1. Background and Scope of the investigation

1.1 Background

With the aim of improving its corporate culture, IHI Power Systems Co., Ltd. (IPS) has been conducting communication activities to allow employees to engage in discourse with the human resources department and top management. Following the communication activities carried out in late February 2024, an IPS employee reported that the "fuel consumption rates" provided to customers when engine products are shipped were altered using values different from those actually measured during test operations. Upon receiving this report, both IPS and its parent company IHI Corporation (IHI) conducted interviews with relevant personnel.

The interviews confirmed that the contents of the report were true, and that in the process of testing the engines manufactured at IPS and preparing the records, values differing from those actually measured during test operations were entered in the records (hereinafter referred to as "**misconduct**"). IHI and IPS accordingly formed a crisis management headquarters to investigate the records and conduct further interviews. On April 24, 2024, IHI reported the identified misconduct to the relevant government ministries and agencies, additionally holding a press conference and disclosing the matter in a timely fashion. Subsequently, a Special Investigation Committee[1] chaired by Hiroshi Kimeda of Nishimura & Asahi was commissioned to conduct a review from a third-party perspective by outside experts.

After that, the progress of the investigation was reported to the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and timely disclosed on June 4, 2024 and August 21, 2024.

This report is based on the Investigation Report from the Special Investigation Committee (Appendix 1) and combines the independent investigations of IHI and IPS to summarize matters including the facts related to the misconduct, analyze its causes, and present measures to prevent recurrence.

1.2 Scope of the Internal investigation

The misconduct was confirmed to have occurred in the test operation processes carried out as part of the engine manufacturing at the IPS plant. IPS possesses the four manufacturing bases of Niigata Engine Plant (Niigata City, Niigata), Ohta Plant (Ota City, Gunma), Niigata Gas Turbine Plant (Kitakanbara Gun, Niigata), and Niigata Foundry Plant (Niigata City, Niigata). Engines are manufactured at Niigata Engine Plant and Ohta Plant. The Niigata Gas Turbine Plant manufactures and tests gas turbines for the generation of electricity, while the Foundry Plant solely manufactures engine components.

The misconduct was confirmed to have occurred at Niigata Engine Plant and Ohta Plant where engines are manufactured. No misconduct has been confirmed at the Niigata Gas Turbine Plant or the Niigata Foundry Plant.

The misconduct was committed during the measurement of fuel consumption rates conducted as part of the engine test operations process at the plants. There are two fuel consumption rate measurements, each of which is measured separately.

(1) Measurements carried out when delivering engines to customers (hereinafter referred to as "**pre-shipment test operations**") in order to confirm whether engine performance meets the specifications, including fuel consumption rates, prior to shipment from the plant.

(2) Measurements carried out when verifying NOx emissions (hereinafter referred to as "**NOx emissions verification**,"[2] because measured fuel consumption rates are used as the basis

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[1] The Special Investigation Committee is composed of Hiroshi Kimeda, (Chairman; Lawyer, Nishimura & Asahi (Gaikokuho Kyodo Jigyo)), Makoto Shimamoto (Part-time lecturer, Faculty of Science and Technology, MEIJO UNIVERSITY, Former Director, Yamaha Motor Co., Ltd.), and Mitsuhiro Umezu (Ph.D., President and CEO, Umezu Institute of Business Ethics, Former Professor, Corporate Ethics, Keio University). The objectivity and independence of the investigation is ensured by appointing as committee members lawyers and experts who had no involvement in the internal investigation and had no conflicts of interest with IHI.

[2] NOx regulations for ship engines are based on MARPOL 73/78 (International Convention for the Prevention of Pollution from Ships) as adopted by the International Maritime Organization, and have been passed into Japanese law under the Act on Prevention of Marine Pollution and Maritime Disaster.According to the applicable regulations, certificates are issued to engines that have been inspected for NOx emissions and approved according to the EIAPP manual. If the NOx emissions verification is performed on a prototype engine (hereinafter referred to as "parent engines"), subsequently manufactured engines of the same type and power band (hereinafter referred to as "member engines") will be deemed to have the same NOx emissions values as the corresponding parent engine and be issued certificates accordingly. This handling is based on the NOx Technical Code regulations. When verifying NOx emissions, engine fuel consumption rates are used as one of the parameters to calculate NOx emissions. Tier I NOx regulations went

for calculating NOx emissions) for the purpose of obtaining Engine International Air Pollution Prevention (**EIAPP**) certificates.

The scope of the investigation related to this case of misconduct covers both the pre-shipment test operations and NOx emissions verification conducted at both Niigata Engine Plant and Ohta Plant. In addition, investigations were carried out in relation to laws and regulations that may have been affected by the misconduct.

2. Structure and method of the investigation

2.1 Structure and development of the investigation

Following the report of this case of misconduct, IHI and IPS have conducted an investigation of the misconduct. A public announcement was made on April 24, 2024, with the investigation proceeded from the next day under the following structure.

- Head of the task force: IHI Senior Executive Officer in Charge of Company-Wide Quality
- Team responsible for investigating the causes and devising measures to prevent recurrence: composed of around 50 persons
- Customer response team: composed of around 50 persons
- Team for the investigation of records: composed of around 100 persons

The investigation and external public announcements developed as follows:

- Late February	- Misconduct reported
- March 1	- Content of the report shared with the IPS President
- March 5	- IPS internal investigation launched
- March 7	- Results of IPS internal investigation reported to IHI - IHI crisis management headquarters established, with IHI Managing Executive Officer and President of Resources, Energy and Environment Business Area[3] as the head of the task force. - Investigation launched under the leadership of the IHI General Manager of Quality Assurance for the Resources, Energy and Environment Business Area. - IHI launched interviews of IPS personnel and a full-scale investigation of test operation records.
- April 11	- The investigation revealed the severity of the situation, so the structure was strengthened, with the IHI Senior Executive Officer in Charge of Company-Wide Quality selected as the head of the task force.
- April 24	- Misconduct reported to the relevant government ministries and agencies. - Timely disclosure carried out and press conference held.
- May 1	- The Special Investigation Committee formed.
- June 4	- Interim Report submitted to the MLIT Maritime Bureau.
- August 21	- Investigation Report submitted to the MLIT Maritime Bureau.
- October 30	- Report on the misconduct based on the Investigation Report of the Special Investigation Committee released.

2.2 Investigation method

2.2.1 Investigation of compliance with NOx regulations

Fuel consumption rates are calculated and used during the process of verifying NOx emissions. Therefore, as part of this investigation, past records of NOx emissions verification were studied to see if there were any differences between the actually measured fuel consumption rate values recorded in IPS internal records (hereinafter referred to as the "**actual measured values**") and the "recorded values" of fuel consumption rates entered in

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into force in 2005 (for overseas ships, retroactively applied effective from 2000), followed by the Tier II regulations (a 20% reduction over Tier I) in 2011 and Tier III (an 80% reduction over Tier I, albeit in specified waters) in 2016.

[3] IHI has adopted a business area structure, and the business area responsible for overseeing IPS, where the misconduct was confirmed, is one of the four business areas.

the NOx emissions verification reports. In addition, it was confirmed whether the values measured concerning atmospheric temperature, atmospheric humidity, etc., which are necessary for calculating NOx emissions, were altered. When there were differences in the actual measured values and recorded values, the NOx emissions were reevaluated by using the actual measured values to calculate the emissions. At the same time, interviews were also conducted to investigate matters such as whether there was any alteration of fuel consumption rates during NOx emissions verification, whether records that entered the actual measured values were kept, and what could have motivated the misconduct.

2.2.2 Investigation of pre-shipment test operations

The following procedures were conducted for pre-shipment test operations.

(1) Comparison of the actual measured values and the "recorded values" entered in the pre-shipment test operation reports provided to customers.
(2) Comparison of the actual measured values and the fuel consumption rate values entered in the specification documents provided to customers (hereinafter referred to as "**specification values**").
(3) Confirmation of the presence of any misconduct besides the alteration of fuel consumption rates.[4]

In addition, interviews were conducted with all engine test operators and personnel with experience of engine test operations, as well as a broad range of related persons, to ascertain what could have motivated the misconduct and whether there was any awareness of misconduct occurring.

3. The facts as revealed by the investigation results

3.1 NOx emissions verification

When NOx emissions verification was carried out at Niigata Engine Plant, the actual measured values of fuel consumption rates were written down on forms used for keeping internal records. If these figures satisfied the specification values, the actual measured values were entered into computers. However, it was confirmed that in some cases, when the figures did not satisfy the specification values, the actual measured values were altered.

The main model used at Niigata Engine Plant was a low-speed engine. The specification values for this engine were strictly set, so there were cases where the specification values of fuel consumption rates were exceeded in order to satisfy the NOx regulation values. Interview respondents testified that test operators of IPS had a concern that the fuel consumption rates at the time of NOx emissions verification would become known to customers, and customers would then compare the differences with the fuel consumption rates of the pre-shipment test operations submitted at the time of shipment. The fuel consumption rates were therefore altered to avoid discrepancies. In addition, we also confirmed that it was not only the fuel consumption rates, but that some records were altered for the values measured concerning atmospheric temperature, atmospheric humidity, etc.[5], which have an impact on the calculations of NOx emissions.[6]

At Ohta Plant, on the other hand, no alteration of fuel consumption rates or values measured concerning atmospheric temperature and atmospheric humidity during NOx emissions verification was confirmed. The reason for this is thought to be that the main model used at Ohta Plant was a medium-speed engine that would not exceed the specification values of fuel consumption rates,

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[4] Internal records include a history column where events that occurred during the pre-shipment test operations can be recorded. The contents of these history columns was checked to confirm the presence of any misconduct besides the alteration of fuel consumption rates.

[5] In addition, at Niigata Engine Plant, there were cases where values that needed to be measured at the time of NOx emissions verification (specifically, blower inlet temperature, intake air temperature, and air temperature (air cooler outlets)) were altered. It was confirmed that the act had no impact on the calculations of NOx emissions.

[6] Note that the values measured concerning atmospheric temperature and atmospheric humidity, are needed when converting measured concentration (ppm) to emissions (g/kWh) at the time of NOx emissions verification. These measured values were altered, an act motivated by a desire to show a narrow variation in each load operation. This alteration was verified 60 times and the difference in the NOx emissions through such alteration was 1.3% at average, with a maximum of 5.9%. For this alteration, recalculation was performed using the actual measured values prior to alteration and the categories were revised at the time of the August 21, 2024 report.

even when operated in accordance with NOx regulation values. As a result, the motivation for the misconduct was absent.

The misconduct in the NOx emissions verification is therefore judged to have occurred only at Niigata Engine Plant.

The results of the NOx emissions verification investigation are divided into the following four categories.

- Category A: No alteration of actual measured values could be confirmed, and there was no deviation from the NOx regulation values.
- Category B: Alteration of actual measured values was confirmed, but when NOx emissions were calculated using the actual measured values as written on internal records, there was no deviation from the NOx regulation values.
- Category C: Alteration of actual measured values was confirmed, and when NOx emissions were calculated using the actual measured values as written on internal records, there were deviations from the NOx regulation values. (Products that do not comply with international NOx regulations)
- Category D: The actual measured values for the fuel consumption rates that should be used in the calculations when confirming the NOx emissions could not be identified.

The number of parent engines and member engines for NOx emissions verification as of the last report (August 21, 2024) is shown in Tables 3-1 and 3-2.

According to interviews with all employees who have experience confirming the NOx emissions, the employees testified that, when confirming the NOx emissions, there were no improper alterations, such as using bypass lines or manipulating digital fuel flow meters and other alteration as confirmed in the pre-shipment test operations described below in Section 3.2.

Table 3-1 NOx Emissions Verification Survey Results as of August 21, 2024
(Marine Engines for Domestic Use)

Plant	Category	Number of parent engines (Number of NOx emissions verification)	Number of member engines[7] [8] (Number of units shipped)
Ohta Plant	A	125	1,291
Niigata Engine Plant	A	58	86
	B	148	578
	C	9	6
	D	16	19
Total		356	1,980

Table 3-2 NOx Emissions Verification Survey Results as of August 21, 2024
(Marine Engines for Overseas)

Plant	Category	Number of parent engines (Number of NOx emissions verification)	Number of member engines (Number of units shipped)
Ohta Plant	A	182	2,584
Niigata Engine Plant	A	9	20
	B	55	476
	C	1	4
	D	0	4
Total		247	3,088

[7] The number of engines used for NOx emissions verification is included in the number of member engines.

[8] This includes member engines manufactured at a different plant, utilizing the NOx emissions verification results for the inspected plants.

Following the report and timely disclosure to the MLIT Maritime Bureau on August 21, 2024, a technical evaluation committee formed of outside experts was established by MLIT, and technical evaluations were performed regarding measures to comply with standards for Category C and the appropriateness of NOx emissions limits for Category D. The evaluation confirmed that Category D could be transferred to Category A or Category B. As a result, the number of parent engines and member engines involved in NOx emissions verification is shown in Tables 3-3 and 3-4.

Table 3-3 NOx Emissions Verification Survey Results (Marine Engines for Domestic Use)

Plant	Category	Number of parent engines (Number of NOx emissions verification)	Number of member engines (Number of units shipped)
Ohta Plant	A	126	1,291
Niigata Engine Plant	A	59	86
	B	154	595
	C	9	6
	D	8[9]	0
Total		356	1,978

Table 3-4 NOx Emissions Verification Survey Results (Marine Engines for Overseas)

Plant	Category	Number of parent engines (Number of NOx emissions verification)	Number of member engines (Number of units shipped)
Ohta Plant	A	181	2,584
Niigata Engine Plant	A	9	22
	B	56	480
	C	1	4
	D	0	0
Total		247	3,090

3.2 Pre-shipment test operations

Tables 3-5 and 3-6 show the results of pre-shipment test operations survey. There were no changes from the August 21, 2024 report. Most of the misconducts were alterations of actual measured values of fuel consumption rates.[10] As misconducts other than the alteration of fuel consumption rate, at Niigata Engine Plant, (1) alterations using bypass lines to make the fuel consumption rate appear lower[11] and (2) alterations manipulating digital fuel flow meters to make the fuel consumption rate appear lower[12] were confirmed. It was testified that these alterations

[9] Indicates a parent engine that has developed an engine and obtained an EIAPP certificate, but has no sales record. Category D with no sales record is not subject to evaluation by the technical evaluation committee and will continue to be classified as Category D. In the case of new sales of these engines in the future, the appropriate legal procedures such as NOx emissions verification will be performed, so no issues will occur.

[10] Among a few other cases of misconduct, when delivering multiple engines of the same model to a customer at once, there were cases where discrepancies in the data for each engine were discovered, and to avoid explaining these discrepancies to the customer, inappropriate alterations of secondary cooling water temperature, pressure, and fuel oil pressure were verified. Of these alterations, although the secondary cooling water temperature had the potential to affect the fuel consumption rates, as a result of evaluating the impact of these alterations, it was verified that there was a minor impact on the fuel consumption rates.

[11] Alterations using bypass lines to make the fuel consumption rate appear lower during pre-shipment test operations: (three cases confirmed) Alterations during pre-shipment test operations at Niigata Engine Plant, fuel should flow from the fuel supply system with a fuel flow meter installed, but the bypass line valve set up for maintenance purposes was opened to make the fuel bypass the flow meter, which made the displayed fuel flow rate appear lower than the actual fuel flow rate. In Table 3-5, all three cases were recorded as “Number of units subject to misconduct” and “Number of units deviating from specification values.”

[12] Alterations manipulating digital fuel flow meters to make the fuel consumption rate appear lower during pre-shipment test operations: (49 cases confirmed)
During pre-shipment test operations at Niigata Engine Plant, the meter coefficient of the digital fuel flow meter was improperly altered, making the displayed fuel flow rate appear lower than the actual fuel flow rate. Of these, we were able to verify the actual fuel flow rate from the details of the alteration of the meter coefficient for 37 cases, and evaluated the deviation from specification values using the actual fuel flow rate. Engines for which we were unable to verify the actual fuel flow rate were recorded in

were made in order to avoid the exposure of the act of altering the actual measured values during the pre-shipment test operations when the customer attended and carefully observed the measurement items.

Table 3-5 Number of Misconducts in Pre-Shipment Test Operations Since 2003

Product Category	Destination	Number of units shipped	Number of units subject to misconduct[13]	Number of units deviating from specification values[14]
Marine engines	Japan	1,973	1,690	572
	Overseas	3,360	3,064	1,368
	Subtotal	5,333	4,754	1,940
Land use engines	Japan	1,168	128	7
	Overseas	66	35	5
	Subtotal	1,234	163	12
Total		6,567	4,917	1,952

Table 3-6 Number of Misconducts in Pre-Shipment Test Operations Prior to 2002

Product Category	Destination	Number of engines for which records were verified[15]	Number of units subject to misconduct	Number of units deviating from specification values[16]
Marine engines	Japan	663	552	98
	Overseas	1,373	1,061	114
	Subtotal	2,036	1,613	212
Land use engines	Japan	339	68	14
	Overseas	379	232	107
	Subtotal	718	300	121
Total		2,754	1,913	333

3.3 Impact on other regulations, etc.

Compliance with the following laws and regulations was also confirmed.

① About the Ship Safety Act for marine engines

No violations of regulations on engine safety under the Ship Safety Act have been identified.

② Response to EEDI[17]/EEXI[18] applicable to passenger and cargo vessels engaged in international voyage in accordance with MARPOL 73/78 (International Convention for

"Number of units subject to misconduct" and "Number of units deviating from specification values" in Table 3-5.

[13] Number of engines with different actual measured values and recorded values is shown.

[14] Number of engines for which actual measured values were found to have deviated from the specification values provided to customers. The degree of deviation from specification values is an average of 1.7%, with a maximum of 19.4% for marine engines, and an average of 2.6% with a maximum of 10.2% for land-use engines. The averages were calculated for the engines that deviated from the specification values (marine engines: 1,940 units, land-use engines: 12 units).

[15] Number of engines for which records were verified in the investigation records (shipped from December 1974)

[16] Number of engines for which actual measured values were found to have deviated from the specification values provided to customers. The degree of deviation from specification values is an average of 3.3%, with a maximum of 27.0% for marine engines, and an average of 1.3% with a maximum of 7.5% for land-use engines. The averages were calculated for the engines that deviated from the specification values (marine engines: 212 units, land-use engines: 121 units).

[17] Energy Efficiency Design Index: An international index used to evaluate and compare the energy efficiency of maritime vessels that applies, in principle, to all internationally sailing ships of 400 GT or more. It has become a standard used to reduce the CO_2 emissions of vessels and lower their environmental burden.

[18] Energy Efficiency Existing Ship Index: An index applied to certain designated internationally sailing ships of 400 GT or more that is used to evaluate and compare the energy efficiency of existing maritime vessels.

the Prevention of Pollution from Ships) adopted by the International Maritime Organization

As a result of investigating engines installed on ocean-going ships, although there were no EEDI cases and one EEXI case (which was a Japanese-flagged ship at the time of shipment but is now a foreign-flagged ship) was confirmed, it was confirmed that the fuel consumption rates measured by IPS were not used, and therefore it was not affected by these misconducts.

Additionally, we are confirming with the foreign classification society whether the engines delivered to foreign classified ships are applicable to EEDI/EEXI.

③ Air Pollution Control Act for land-use engines

The misconducts did not affect the measurement of the amount and concentration of soot and smoke, and there were no land-use engines in violation of the Air Pollution Control Act. In addition, compliance with the Air Pollution Control Act for all land-use engines was confirmed based on measurements conducted by third-party inspection agencies, which confirmed that there were no violations.

④ Fishing Boat Act concerning fishing vessel engines

No engines deviated from the standards of fuel consumption rates prescribed by the Fishing Boat Act.

There have been no confirmed cases of misconduct that affect the safety of the engines during their manufacture and test operations, and there have been no confirmed cases that may raise questions about the safety of the engines during actual use.

3.4 Facts revealed since the previous report (August 21, 2024)

As described in Section 1.1, a verification from a third-party perspective by a Special Investigation Committee was commissioned with respect to the misconduct, and a questionnaire for all IPS employees was conducted as part of that investigation. In this questionnaire, a testimony was obtained that during marine test operations conducted on ships equipped with engines, fuel consumption rates and cylinder pressure in the engines were altered. In both alterations, the actual measured values were altered so that the actual measured values fell within the allowable values, even though they exceeded the allowable values set by the IPS. In response to this testimony, IHI and IPS conducted an investigation into the act in question and conducted an evaluation and verification based on actual measured values. As a result, it was verified that, because the safety devices operated normally and did not exceed the permissible values for the pressure, cylinder pressure does not have any impact on safety when the engine is in use. In addition, the rewriting of the fuel consumption rate did not affect the safety of the vessel.

4. Future responses to NOx regulations

Future responses for the engines categorized in Section 3.1 are described below. Note that Category D is omitted from the following description because it was recategorized to Category A and B based on the evaluation by the technical evaluation cmmittee convened by the MLIT.

4.1 Category A

(No alteration of actual measured values could be confirmed, and there was no deviation from the NOx regulation value)

We have confirmed the NOx emissions for engines of Category A. While confirming compatibility with NOx regulation values, we have verified the measurement and recording work flow, which was corrected and improved in response to the case of misconduct, and confirmed the suitability of the recurrence prevention measures. In response to this, the issuance of certificates from the Classification Society (ClassNK), that is the regulatory authority of the ship's country of registry or the classification society acting on its behalf, resumed for newly manufactured member engines using the certificates of parent engines for which no misconduct was verified (Category A).

4.2 Category B

(Alteration of actual measured values was confirmed, but when NOx emissions were calculated using the actual measured values as written on internal records, there was no deviation from the NOx regulation values)

These engines to be manufactured in the future will be subject to NOx emissions verification under the supervision of regulatory authorities and become new parent engines after being verified as satisfying NOx regulation values. In addition, as a response to engines related to ships under navigation, the issued certificates by the regulatory authority will be revised to the appropriate figures while carefully explaining the information to customers.

4.3 Category C

(Alteration of actual measured values was confirmed, and when NOx emissions were calculated using the actual measured values as written on internal records, there were deviations from the NOx regulation values)

NOx emissions will be reduced to below the regulation values through the permanent measures of adjusting fuel injection timing in engine cylinders, etc., changing turbocharger matching, and changing fuel valve nozzles with approval of regulatory authorities. In addition, until permanent measures to comply with standards are implemented, interim measures will be implemented, such as reducing NOx emissions during actual operations by adjusting fuel injection timing in engine cylinders, etc. In addition, we will apply for amendments to the issued certificates by the regulatory authority and other authorities as required by these measures.

5. Reduction in scope of ISO certification and renouncement of authorization for place of manufacturing business

A special investigation by Bureau Veritas Japan Co., Ltd., an ISO9001 [19]certification body, was conducted following such case of misconduct. As a result, a notice was received on August 9, 2024, stating that it was decided to reduce the certification scope and cancel the "scope related to the manufacture of reciprocating internal combustion engines under the jurisdiction of Niigata Engine Plant and Ohta Plant" of IPS.

In addition, after carefully considering that the basic response policy has been finalized following the completion of the confirmation of the facts concerning the misconduct and that the scope of the ISO9001 certification has been reduced, and given the seriousness of these matters, we will renounce the authorization for place of manufacturing business[20] from MLIT on August 21, 2024.

Going forward, immediate action will be taken to restore the scope of ISO certification and reauthorize manufacturing sites.

6. Analysis of causes

The causes of the misconduct based on the results of the IHI and IPS investigation and the results of the Special Investigation Committee's investigation are as follows.

6.1 Specific causes for the misconducts

The following is a summary of the causes of the misconduct based on the results of the IHI and IPS investigation.

(1) Direct causes for the confirmed misconduct

- The operation inspector belonged to the manufacturing and assembly department, but there was not sufficient independence from manufacturing and assembly to inspection. In addition, the quality control department staff responsible for verifying inspection records did not sufficiently verify them.
- The process of confirming records on-site and reflecting those records in the final plant test report was unclear, and it was not documented as a business process.
- Measurement and recording of fuel consumption rates were conducted manually using an analog method, and the possibility of alteration could not be completely eliminated.

[19] International standards for quality management system

[20] The authorization received from MLIT based on the Ship Safety Act. Businesses that receive this authorization may conduct a portion of the inspections concerning manufacturing work on behalf of MLIT.

・ The operation method for the bypass line in the fuel oil supply line was unclear, and it could be easily manipulated.
・ The meter coefficient of the digital fuel flow meter used to measure the fuel consumption rates was easily adjustable.

(2) Causes related to compliance awareness and organizational culture

Based on the survey results, it is confirmed that the misconducts had placed undue burdens on the on-site operation inspectors, and had been perpetrated over many years without improvement. In addition, similar improper alterations were carried out for many years at two different plants, and many people who were involved in the design, manufacture, etc. of the engines in the past knew about such alterations. However, although this included senior management, the company failed to recognize this and take corrective action.

It is believed that the following issues and background causes related to compliance awareness and organizational culture have led to this situation.

・An organizational culture that allows improper alterations to be passed on

・An organizational culture with a silo mentality that prioritizes the work of one's own department

・Lack of awareness of quality and compliance
- Facile and incorrect justifications on the idea that it is acceptable if the quality records are slightly different from the facts as long as there are no safety issues
- Disregard of specification values and test records provided to customers

・Avoidance of customer explanations

・Lack of understanding and education on laws, regulations, and rules

・Lack of communication between different levels and organizations

・Internal environment in which initiatives to strengthen quality compliance were not fully utilized

In addition, since 2019, although compliance activities have intensified within the IHI Group, many people who recognized the facts of this matter did not speak up because they knew it would cause a major problem if it was made public. Although the role of eliminating psychological barriers (awareness of compliance violations but inability to speak up) lies with management, this role had not been fulfilled. In addition, considering that multiple officers and employees of IPS knew about the facts of this matter, the problems within the organization and management were significant.

6.2 Specific causes for the misconducts investigated by the Special Investigation Committee

The causes of the misconduct pointed out by the Special Investigation Committee are summarized as follows. For details of the results of the analysis of causes, please refer to the Investigation Report prepared by the Special Investigation Committee (Appendix 1).

(1) Factors that prevented the misconduct from being corrected internally even though it continued for a long period of time and many officers and employees were involved and aware of it

(a) Because the issue of misconduct became too large to address, employees in the field were reluctant to raise the issue and take action to correct the situation.
(b) At Niigata Engine Plant and Ohta Plant, managers were rarely transferred from other divisions of IPS or other IHI Group companies and some senior management were involved in or tacitly approved of the misconduct, leading employees in the field to believe that correction was not possible.
(c) IPS senior management did not act on the growing awareness of quality compliance in society at large.
(d) A barrier was felt between the presidents and others from the parent company, who would be replaced in a few years, and it was not possible to confide in them about the misconduct.
(e) Because numerous officers and employees, including those in the Quality Assurance Department and Quality Control Department, were involved or aware of the misconduct, it was difficult for the IPS internal control system to detect and correct the misconduct at an early stage.

(2) Lack of data integrity[21]

(a) Actual measured values were altered over a long period of time, and resistance to the misconduct had diminished.
(b) Although the alteration of actual measured values was initially started to correct measurement errors, gradually the alteration to baseless values was performed for the purpose of avoiding explanations to customers.
(c) No capital investment or other efforts were made to improve measurement accuracy over a long period of time.
(d) There was no longer a healthy corporate culture that respects data.

(3) Lack of crisis awareness among directors and department heads

(a) Some officers and employees were aware of this misconduct even before being appointed as department heads or directors, but after their promotion, they still did not take any corrective action.
(b) There was a belief that the misconduct would not be discovered because customers could not ascertain the correct fuel consumption rates.
(c) There was also a misguided belief that there would be no whistleblowing about the misconduct.

(4) Closed organizational culture with a silo mentality

(a) At Niigata Engine Plant and Ohta Plant, there were no transfers of managers from other IPS departments or IHI Group companies, leading to a closed organizational culture.
(b) There was a silo mentality in which the job of the development department was to complete development, and the job of the production department was to keep products within specifications at the mass production stage.
(c) Even when requesting the sales departments to explain specification changes to customers, there was little company-wide cooperation to resolve the issue.

(5) The meaning of the specification values was not accurately understood

(a) There was a tendency to regard the specification values as something only set by contract and less significant compared to regulation values.
(b) There was a misunderstanding or disregard for compliance with specification values.

(6) Setting of development target values was inappropriate, and transition judgment criteria were unclear, etc.

(a) There were no QMS such as development judgment criteria or regulations that considered the margin of environmental factors (such as test environment temperatures), and sufficient margins were not included in the development target values.
(b) There were no transition judgment criteria during the development stage, nor were there any criteria such as a method of resolution at technical meetings to determine transition judgments.
(c) A QMS was not established and continuously improved regarding the setting of development target values.
(d) The specific role of the quality assurance department in setting development target values and transition judgments was not specified.
(e) When considering compliance with NOx secondary regulation values, instead of basing the catalog fuel consumption values on the actual measured values of individual existing engines, the catalog values for fuel consumption rates during the NOx secondary regulation were uniformly determined to avoid a significant deterioration compared to previous values.

(7) Avoidance of customer explanations

(a) There was a failure to explain to customers that the fuel consumption rates did not meet specification values out of fear of losing future orders.
(b) There was an attitude of taking the easy route of avoiding customer explanations in the sales departments and production departments.

[21] Data completeness, consistency, and accuracy.

(8) Failure of checks and balances among the internal audit departments, quality assurance departments, and quality control departments

(a) Internal audits by the Internal Audit Department did not sufficiently focus on quality.
(b) Although the Quality Assurance Department conducted audits related to ISO certification, it did not perform its required functions, such as not conducting sufficient audits of quality itself.
(c) The Quality Control Department only verified the documents submitted by the operational inspection staff, without cross-referencing with original data.
(d) There was no system in place for the Quality Assurance Department to be actively involved in setting development methods and development targets at the development stage, and the checks and balance function of the Quality Assurance Department and the Quality Control Department was insufficient at the stage of checking test reports after the transition to mass production.
(e) Personnel involved in the misconduct were employed in the Quality Assurance Department and the Quality Control Department.

(9) IHI's quality governance did not function properly

(a) The IPS Quality Assurance Department did not perform its required functions, for example, it provided false explanations to the IHI's Quality Assurance Department of the Resources, Energy and Environment Business Area as if there were no issues, despite fuel consumption rates deviating from specification values.
(b) There were insufficient responses, such as case studies, to increase the sensitivity of IHI's Quality Assurance Department of the Resources, Energy and Environment Business Area to signs of quality irregularities.

7. Specific measures to prevent recurrence

Based on the results of the investigation and analysis of causes conducted by IHI and IPS, measures can be broadly divided into the following four policies.

(Policy 1) Introduction of a new mechanism and establishment of a system for conducting tests and inspections that do not cause misconducts
(Policy 2) Restructuring of overall business processes, including improvement of technical specification decision processes, and continuous review and improvement through mutual collaboration and cooperation between departments
(Policy 3) Thorough review of organizational culture and fostering of a new organizational culture
(Policy 4) Fundamental review and restructuring of the organization and personnel system to prevent recurrence

Measures to prevent recurrence were developed based on these four policies. Specific measures to prevent recurrence are listed below, along with their relation to the findings of the Special Investigation Committee.

(Policy 1) Introduction of a new mechanism and establishment of a system for conducting tests and inspections that do not cause misconducts

Measures to prevent recurrence	Measure 1 Automate and reform measurement of fuel consumption rates Measure 2 Ensure the independence of quality control departments
Causes analyzed by the Special Investigation Committee (shown in Chapter 6)	(2) Lack of data integrity (8) Failure of checks and balances among the internal audit departments, quality assurance departments, and quality control departments

Measure 1 Automate and reform measurement of fuel consumption rates

We established regulations for the entire workflow from on-site record confirmation to the final plant test report for NOx emissions verification and pre-shipment test operations.

We have introduced and implemented automated measuring equipment for the measurement and recording of fuel consumption rates during NOx emissions verification and pre-shipment test operations from August 5, 2024. In conjunction with this, digital fuel flow meters, which were calibrated and sealed by the manufacturer, were introduced.

The bypass line installed in the fuel oil supply line used during the NOx emissions verification and pre-shipment test operations was removed and was implemented on May 28, 2024.

Measure 2 Ensure the independence of quality control departments

The direct supervisor of the quality control department was present at the tests to confirm NOx emissions and pre-shipment test operations, and the direct supervisor himself checked and recorded the actual measured values. In addition, as shown in Appendix 2, we reviewed the organization to ensure the independence of tests and inspections and strengthen the quality control department through measures such as transferring test operation inspection functions such as the creation of pre-shipment test operation records to the quality control department, and separating it from the manufacturing department.

(Policy 2) Restructuring of overall business processes, including improvement of technical specification decision processes, and continuous review and improvement through mutual collaboration and cooperation between departments

Measures to prevent recurrence	Measure 3 Clarify the appropriate setting of development target values, transition judgment criteria, and adjustments during production Measure 4 Clarify response to cases where fuel consumption rate does not fall within specification values Measure 5 Establish an integrated responsibility system for the entire product lifecycle Measure 6 Strengthen check and balance functions
Causes analyzed by the Special Investigation Committee (shown in Chapter 6)	(4) Closed-off organizational culture with a silo mentality (6) Setting of development target values was inappropriate, and transition judgment criteria were unclear, etc. (8) Failure of checks and balances among the internal audit departments, quality assurance departments, and quality control departments (9) IHI's quality governance did not function properly

Measure 3 Clarify the appropriate setting of development target values, transition judgment criteria, and adjustments during production

We have set development targets in internal regulations for parameters with previously unclear targets, such as fuel consumption rates, based on the results of demonstration tests using prototype models and taking into account variations in mass production.

In addition, the product supervisor (Measure 5), which will be described later will be

responsible for making transition decisions at each step from development to mass production, which had previously been ambiguous. Furthermore, a system will be built to strictly review transition decisions with authority and responsibility by a newly established Product Judging Group within the Quality Assurance Department (Measure 6).

For newly developed engines, the setting of specification values for parameters such as fuel consumption rates will be handled through an appropriate development process as described above. For engines that have already been shipped, appropriate values shall be re-set after evaluating the actual measured data of parameters such as fuel consumption rates.

Furthermore, we have clearly defined items to be checked and adjusted in case of deviation from appropriate fuel consumption rates or other targets set by the above in internal regulations related to operation and inspection standards during engine production.

Measure 4 Clarify response to cases where fuel consumption rate does not fall within specification values

If the fuel consumption rates or other parameters are not within specification values even after checking and adjustment according to Measure 3, the Quality Control Department will report to General Manager of the Quality Assurance Department and initiate the non-conformity response process.

In the non-conformity response process, relevant the Quality Assurance Department, the Quality Control Department, design departments, manufacturing departments, and sales departments will discuss how to respond and decide on either special adoption, parts remanufacturing, or a different response. The General Manager of the Quality Assurance Department will then instruct the relevant departments to analyze and investigate the factors from quality, manufacturing, design, contract, and composite perspectives, and to take corrective actions.

We have clearly stated these series of processes in internal regulations and established a system that prevents production departments from being left to deal with cases where the fuel consumption rate does not meet specifications.

Measure 5 Establish an integrated responsibility system for the entire product lifecycle

We have established a product supervisor for each engine model to be responsible for technology, quality, and product safety throughout the entire product lifecycle. These product supervisors will have the authority to secure the necessary resources, and will review specifications, manage changes, and gather and evaluate operational data even after the start of mass production. Through this new system, we will review the silo mentality of our existing organization, which had placed undue burden on on-site operations, and build a cooperative system that transcends departments. Product supervisors will be appointed by the Director of the Engineering & Technology Center and by the President of IPS.

Measure 6 Strengthen check and balance functions

We will review the quality assurance and quality control systems of IPS to optimize their check and balance functions by ensuring the independence of quality control departments (Measure 2) and strengthening the authority and responsibility of the General Manager of the Quality Assurance Department (Measure 11).

In addition, the Product Judging Group of the Quality Assurance Department will conduct reviews of the activities of the Chief Product Officer and QMS activities in the product process (development stage, design, first unit measures, and measures to be taken when a major nonconformity or damage occurs across contract, design, and manufacturing), and will be responsible for the results of these reviews. The head of this Product Judging Group shall be appointed by the IPS President.

The IHI Group as a whole will continue its efforts to improve quality and compliance by strengthening QMS, promoting voluntary reporting, allocating and training human resources, and strengthening checks and balances.

(Policy 3) Thorough review of organizational culture and fostering of a new organizational culture

Measures to prevent recurrence	Measure 7 Foster an open organizational culture Measure 8 Revitalize personnel rotation Measure 9 Raise officers and employees awareness and enhance educational programs Measure10 Establish a support system for customer response
Causes analyzed by the Special Investigation Committee (shown in Chapter 6)	(1) Factors that prevented the misconduct from being corrected internally even though it continued for a long period of time and many officers and employees were involved and aware of it (2) Lack of data integrity (4) Closed organizational culture with a silo mentality (5) The meaning of the specification values was not accurately understood (7) Avoidance of customer explanations (9) IHI's quality governance did not function properly

Measure 7 Foster an open organizational culture

As a response to the fact that this misconduct continued over a long period of time and was not corrected internally despite the involvement and awareness of numerous officers and employees, we will strengthen our quality assurance system and thoroughly review our organizational culture in a manner that is not bound by common sense or customary practices within IPS. At IPS, we will continue dialogue between employees, personnel, and management, and implement initiatives to improve management capabilities. As a response to the misconduct, we will transfer and assign quality assurance and quality control managers from other IHI Group companies to foster a more open organizational culture.

Measure 8 Revitalize personnel rotation

Revitalizing personnel rotation is an effective means to remove the seeds of misconduct that have become embedded due to long-standing practices and to review the organizational culture.

IPS has been continuously reviewing its organization since FY2022. We have been striving to systematize personnel rotation in order to avoid the silo mentality of the organization and the individualization of work among different personnel, as well as to renew revitalize the organization. Going forward, we will strive for further revitalization by strengthening monitoring of the retention status of positions above a certain level and expanding the scope of human resource exchange from within IPS to the Resources, Energy and Environment Business Area.

At the same time, the IHI Group as a whole will implement human resource exchange, reeducation, and reassignment in a multifaceted manner.

Measure 9 Raise officers and employees awareness and enhance educational programs

in order to rebuild a healthy corporate culture that respects data, we will hold quality trainings by outside experts, education on the significance and importance of data integrity, compliance education, and communication training that incorporates perspectives such as assertion. In doing so, we will continuously work to foster an organizational culture that leads to the prevention of misconduct and raising awareness of all relative.

Additionally, for all employees of the IHI Group, we will continuously conduct training that addresses not only efforts to correct inappropriate actions but also the fundamental causes and mechanisms of misconduct, measures to prevent such occurrences, and the perspectives to be maintained in these situations.

Through these initiatives, we aim to reform the awareness of all employees within the IHI Group, transform the organizational culture, and rebuild the QMS.

Measure 10 Establishing a Support System for Customer Response

To prevent the avoidance of customer explanations in the future, we will establish a system where the Product Supervisor (Measure 5) has an advisory role. This system will provide

guidance to the sales department and quality control department, among others, when they need to explain issues to customers.

(Policy 4) Fundamental review and restructuring of the organization and personnel system to prevent recurrence

Measures to prevent recurrence	Measure 11 Strengthen the authority and responsibility of the General Manager of the Quality Assurance Department Measure 12 Review the executive education program and Establishment of an appropriate PDCA cycle Measure 2, 3, 5, 6, 10 (aforementioned)
Causes analyzed by the Special Investigation Committee (shown in Chapter 6)	(1) Factors that prevented the misconduct from being corrected internally even though it continued for a long period of time and many officers and employees were involved and aware of it (3) Lack of crisis awareness among directors and department heads (4) Closed organizational culture with a silo mentality (9) IHI's quality governance did not function properly

In addition to measures 2, 3, 5, 6, and 10, the following measures will be implemented as a fundamental organizational and system review.

Measure 11 Strengthen the authority and responsibility of the General Manager of the Quality Assurance Department

Directors of IPS will be in charge of the General Manager of the Quality Assurance Department. This will strengthen the authority and responsibility of the General Manager of the Quality Assurance Department at IPS and enhance governance through quality assurance.

Measure 12 Review the executive education program and Establishment of an appropriate PDCA cycle

We will review the education provided to senior management, including executives of Group companies. Specifically, we will shift the focus from acquiring knowledge necessary for company management to enhancing awareness of their roles and responsibilities. By conducting various training sessions related to misconducts both within and outside the IHI Group, we aim to further foster awareness of quality and other issues, strengthen governance, and ensure thorough compliance.

Through these initiatives, the entire IHI Group, with the executives and the Board of Directors at the center, will promote continuous improvement activities aimed at enhancing the QMS that consists of core of the management and ensure the proper implementation of the PDCA cycle.

8. Conclusion

This report clarifies the facts related to this misconduct and summarizes the causes and measures to prevent recurrence. The IHI Group as a whole will respond to this report by proceed with the prevention of recurrence with a high sense of urgency.

At the same time, we will proactively work to reform IPS and resolve industry-wide issues related to marine engines.

Misconduct such as this must never occur. Each and every one of our employees will strongly recognize this incident as a lesson to be learned, and will work diligently to make sure that compliance is thoroughly addressed with high ethical standards and a humble attitude to ensure that it takes root as a true part of our corporate culture. In addition, we will work together as one to restore confidence in the IHI Group as a whole.

(END)

October 30, 2024

To: IHI Corporation
To: IHI Power Systems Co., Ltd.

Investigation Report

Special Investigation Committee

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I Introduction

In late February of 2024, IHI Power Systems Co., Ltd. (**IPS**), during a communication activity between its employees, human resources department, and top management with the aim of improving its corporate culture, received a report from an IPS employee that fuel consumption rates in test reports submitted to customers when engine products are shipped had values different from the values measured during test operations (hereinafter referred to as the "**misconduct**"). Therefore, IPS and its parent company, IHI Corporation (**IHI**) conducted an internal investigation, including a collation of the test reports with the internal records of the test operations kept by IPS and interviews with IPS personnel. As a result, the misconduct was confirmed at the Niigata Engine Plant and the Ohta Plant of IPS. In response to this, IHI and IPS announced on April 24, 2024, that the misconduct had been confirmed. In light of the seriousness of the misconduct, IHI and IPS established a Special Investigation Committee (hereinafter referred to as the "**Committee**") by external experts on May 1, 2024 in order to clarify the entire picture of the incidents, analyze the causes, and compile measures to prevent recurrence.

The Committee consists of the following members.

Chairman	Hiroshi Kimeda, Lawyer, Nishimura & Asahi (Gaikokuho Kyodo Jigyo)
Committee Member	Makoto Shimamoto, Part-time lecturer, Faculty of Science and Technology, MEIJO UNIVERSITY, former Director of Yamaha Motor Co., Ltd.
Committee Member	Mitsuhiro Umezu, Ph.D., President and CEO, Umezu Institute of Business Ethics, former professor of Keio University (Business Ethics)

In addition, lawyers[1] affiliated with Nishimura & Asahi (Gaikokuho Kyodo Jigyo), an external law firm, assisted the Committee in its investigations.

The scope of the investigation commissioned by IHI and IPS to the Committee was to clarify the entire picture and analyze the causes of quality-related inappropriate conduct, including the misconduct, in products designed and developed and manufactured by IPS, and to propose measures to prevent recurrence.

As described above, IHI and IPS have collated the internal records of the test operations with the test reports kept by IPS and have conducted interviews with related parties within IPS. Based on the results of these investigations, IHI and IPS have determined the facts, analyzed the causes, and considered measures to prevent recurrence (The above-mentioned internal investigation conducted by IHI and IPS as of October 29, 2024 is hereinafter referred to as the "**Internal Investigation**.").

By verifying the records on the Internal Investigation and conducting interviews, etc. separately from the Internal Investigation[2], the Committee, as an external expert, has examined the Internal Investigation and analyzed the causes and considered measures to prevent recurrence from its own standpoint. In addition, the Committee conducted a questionnaire survey on quality-related issues targeting a total of 1,541 people,

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[1] Jun Katsube, Makoto Takahara, Masamichi Kamijima, Kentaro Ohno, Toshihiro Suzuki, Asaki Nishida, Yohsuke Nakamura, Keiko Matsumoto, Hiromasa Kamiyama, Masato Sawai, Harunobu Uchida, Nanae Suzuki, and Kyohei Yamaki assisted the investigation.

[2] Specifically, the Committee scrutinized and examined the organization chart, internal manuals, meeting materials, customer specifications, inspection records, test reports, audit materials, internal whistle-blowing materials, educational materials, etc. existing at IPS. In addition, the Committee conducted interviews with a total of 71 officers and employees who are or were affiliated with IPS and IHI. Note that some of the people interviewed were interviewed more than once.

including IPS officers and employees, and officers and employees in charge of engines in the procurement department of IHI Resources, Energy and Environment Business Area[3] (Responses were received from 1,314 people, for a response rate of 85.3%.).[4]

This report reports on the investigation conducted by the Committee up to the reference date of October 29, 2024. As of the reference date, the investigation based on the results of the above questionnaire is ongoing, but no serious incidents have been found[5]. After the submission of this report, the Committee will continue to cooperate with the IPS in its investigation. If serious incidents are found as a result of the investigation, the IPS will respond appropriately based on the information provided by the Committee.

The investigation results are as follows.

II History and overview of IPS

(A) History, business descriptions, and capital relationship

IPS was founded in 1895 as Niigata Engineering, an engineering plant of Nippon Oil Co., Ltd. (hereinafter referred to as "**Nippon Oil**"). In 1910, Niigata Engineering spun off from Nippon Oil, and Niigata Engineering Co., Ltd. (hereinafter referred to as "**Niigata Engineering**") was established. In 2001, Niigata Engineering filed for bankruptcy protection under the Corporate Reorganization Act, and in 2003, IHI[6] established Niigata Power Systems Co., Ltd. (hereinafter referred to as "**Niigata Power Systems**"), a 100% subsidiary of IHI, and Niigata Power Systems took over the engines and turbines business of Niigata Engineering. In 2019, Niigata Power Systems absorbed Diesel United, Ltd. (hereinafter referred to as "**Diesel United**"), a 100%-owned subsidiary of IHI, and took over the design and development, manufacturing, and sales of large marine diesel engines, dual-fuel engines, and land-use diesel engines[7], also took over the design and development of large gas turbines[8] from IHI and changed its trade name to IHI Power Systems Co., Ltd.

IPS' business is broadly divided into the marine engine business (hereinafter referred to as "**Marine Power System Business**") and the land-use engine business (hereinafter referred to as "**Power System Plants Business**"). The Marine Power System Business is a business that designs, develops, manufactures, and sells diesel engines, dual-fuel engines, electronic fuel injection control systems (common-rail systems),

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3 IHI consists of four business areas, each of which is in charge of multiple strategic business units (SBUs), including subsidiaries. IPS is overseen by the Resources, Energy and Environment Business Area.

4 The survey was conducted via a signed web questionnaire, with a response period from May 24 to October 29, 2023. Questionnaire responses were received by the Committee directly from the respondents, not through IPS, in order to ensure their anonymity. In the request for cooperation in the questionnaire, it was specified that the internal punishment may be reduced or exempted in case of voluntary reporting of quality-related inappropriate problems (so-called discretionary internal leniency).

5 As a result of the questionnaire survey, there were several reports of data alteration that did not constitute a violation of laws and regulations, such as data alteration of fuel consumption rate and engine cylinder pressure in maritime test operations, in addition to the misconduct, and investigations are ongoing.

6 In 2003, the trade name was Ishikawajima-Harima Heavy Industries Co., Ltd., but in 2007 it was changed to the current IHI Corporation.

7 The design, development, and manufacturing of the engines succeeded from Diesel United were conducted at IPS' Aioi Works. The business succeeded from Diesel United was transferred to Mitsui E&S Co., Ltd. on April 1, 2023.

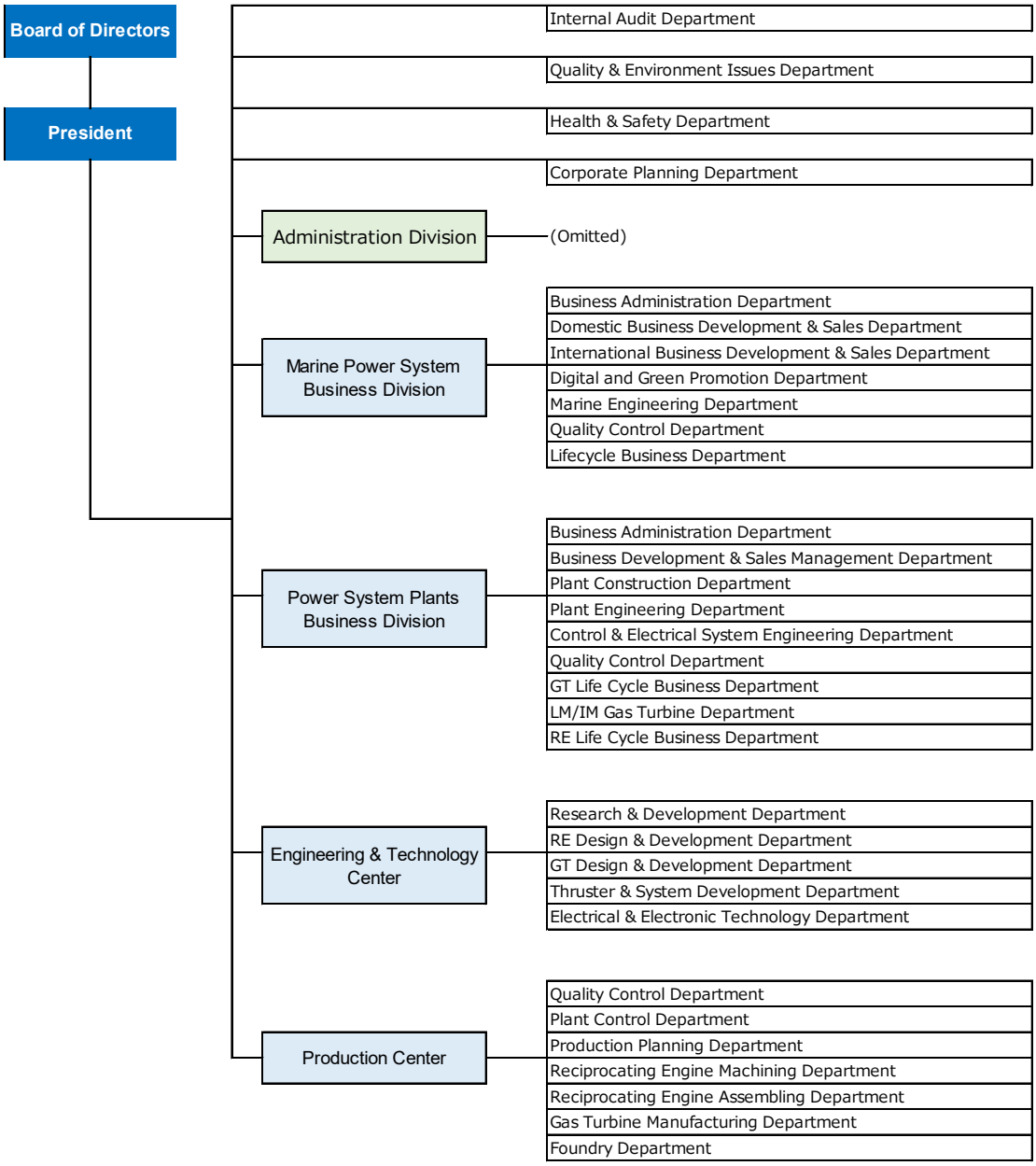
8 Large gas turbines are manufactured at IHI's Kure Aero-Engine & Turbo Machinery Works and Mizuho Aero-Engine Works. IPS is developing but not manufacturing large gas turbines.

and Z-PELLER® (azimuth thrusters) for government ships, commercial ships, fishing vessels, tugboats, and work boats. The Power System Plants Business is a business that designs, develops, manufactures, and sells gas engines, diesel engines, and gas turbines for power plants and railcars.

The Niigata Engine Plant and the Ohta Plant are the design, development, and manufacturing plants for the products of IPS' Marine Power System Business and Power System Plants Business. The Niigata Engine Plant was established in 1966 and is engaged in the design, development and manufacturing of medium to large diesel engines and gas engines. The Ohta Plant was established in 1976 and is engaged in the design, development and manufacturing of small and medium diesel engines, gas engines, and Z-PELLER®.

(B) Organizational structure

An organizational outline of IPS as of February 2024 when the IPS employee reported the existence of the misconduct is as shown in the figure below.



At IPS, the Engineering & Technology Center is in charge of the development of marine engines and land-use engines. The Research & Development Department of the Engineering & Technology Center is responsible for the development of elemental technologies, and the RE Design & Development Department of the Engineering & Technology Center is responsible for the development of new engine models. The Marine Power System Business Division is in charge of the sales and system design related to the Marine Power System Business[9], and the Power System Plants Business Division is in charge of the sales and

[9] The Domestic Business Development & Sales Department and the International Business Development & Sales Department of the Marine Power System Business Division were in charge of the sales related to marine engines, and the Marine Engineering Department of the Marine Power System Business Division was in charge of system design related to marine engines.

system design related to the Power System Plants Business[10]. In addition, the Production Center is in charge of the processes from manufacturing to delivery of marine engines and land-use engines that were ordered as a result of sales. Among these processes, test operations and preparation of test reports are performed by the Assembling Group of the Reciprocating Engine Assembling Department[11] of the Production Center, and quality control such as confirmation of the test reports are performed by the Quality Control Department of the Production Center.

III Business processes in the engine development and mass production phases

In the following, the business processes in the engine development and mass production phases at IPS will be described. Definitions of various numerical values related to fuel consumption rate used in this report are shown in the table below.

Target value	Fuel consumption rate set as a target at the development start evaluation phase
Actual value	Measured fuel consumption rate of the engine under development to determine the degree of achievement of the target value at the development phase
Catalog value (also called nominal fuel consumption)	Fuel consumption rate set for the developed engine as the basic performance of the engine
Specification value (also called guaranteed fuel consumption)	Fuel consumption rate agreed with the customer as the performance of the engine to be delivered based on the specific engine specifications
Measured value	Measured fuel consumption rate in pre-delivery tests for engines to be delivered to customers

(A) Business processes in the development phase

At IPS, the Research & Development Department of the Engineering & Technology Center is responsible for basic engineering operations, research on elemental technologies[12], product strategy planning, and research on new technology trends. The RE Design & Development Department of the Engineering & Technology Center is responsible for the development of new engine models (reciprocating engines) and improvement of engines, etc. In the development of new engine models, the RE Design & Development Department designs new engine models, prepares drawings, examines costs, etc., and the

[10] The Business Development & Sales Management Department of the Power System Plants Business Division was in charge of the sales related to land-use engines, and the Plant Engineering Department of the Power System Plants Business Division was in charge of system design related to land-use engines.

[11] The Assembling Group (Niigata Engine Plant) of the Reciprocating Engine Assembling Department of the Production Center was in charge of test operations at the Niigata Engine Plant, and the Assembling Group (Ohta Plant) of the Reciprocating Engine Assembling Department of the Production Center was in charge of test operations at the Ohta Plant.

[12] Elemental technologies refer to individual technologies required for engine development such as combustion technology.

Research & Development Department also cooperates with the RE Design & Development Department in the performance simulation of the engines to be developed, the test operation of the prototype engine, and the performance confirmation, etc.

The development and design of new products are to be carried out in accordance with the procedures specified in the New Product Development Evaluation System Instruction[13] established by the Engineering & Technology Center. In the New Product Development Evaluation System Instruction, the development of new products is divided into six phases ((a) Development start evaluation, (b) Basic design, performance evaluation, and cost estimate evaluation, (c) Commercialization design and mass production cost evaluation, (d) Beta version[14] delivery evaluation, (e) Development completion and mass production transition evaluation, and (f) Mass production model evaluation) and the evaluating departments, evaluation items, and evaluation procedures for each phase are specified. The business processes are basically the same for both marine engines and land-use engines.

1 Development start evaluation

When deciding whether or not to start development of a new engine model, the RE Design & Development Department and the sales department of the Marine Power System Business Division or the Power System Plants Business Division first investigate and examine the market needs and the products of competitors, and then the RE Design & Development Department discusses and examines with the Marine Power System Business Division or the Power System Plants Business Division to propose a new engine model. When investigating market needs and competitors' products, the sales department will mainly investigate the basic performance (including fuel consumption rate) of competitors' products based on information from customers and product catalogs published by competitors, etc., and will work with the RE Design & Development Department to study target values, etc. of the basic performance for the new engine model. In this phase, the RE Design & Development Department, in consultation with the sales department, sets the development objective, target market, current situation and future trend of the market, market price of the competitor's product, sales strategy, target performance (including fuel consumption rate), and target cost. As for target performance, performance items must be set in order of priority from the first to the fourth, and the fuel consumption rate is often set as a high priority. Note that the sales department does not collect data on NOx emissions from competitors' products because there is a legal limit on NOx emissions, and because IPS customers rarely compare the NOx emissions of IPS products with those of competitors to determine how much margin they have from the limit. The challenge level, etc. of the target performance (including fuel consumption rate) thus set is evaluated by the review members

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[13] This manual applies not only to the development and evaluation of new models, but also to the performance improvement of existing models based on customer requests.

[14] The beta version refers to a small number of engines to be delivered to customers after the performance evaluation of the prototype has been completed. If mass production and delivery of a large number of engines are started immediately after the performance evaluation of the prototype is completed, large costs will be incurred if a major engine failure is found after the engine is actually installed in the ship hull. Therefore, only a small number of engines will be delivered to customers first, and if a major failure is found, design changes, etc. will be considered.

(hereinafter referred to as "**review members**") consisting of the General Managers of the Engineering & Technology Center, the staff of the Quality & Environment Issues Department, the Marine Power System Business Division, the Power System Plants Business Division, and the Production Center and the Procurement Center of IHI Resources, Energy and Environment Business Area (hereinafter referred to as "**Procurement Center**"), and the related chief engineers, etc. In this regard, the target value of the fuel consumption rate is considered to be at least superior to that of the competitor's product based on the data collected by the sales department. The Engineering & Technology Center delivers its opinion from a technical point of view on how much the target value is superior to the fuel consumption rate of the competitor's product, and then the specific target value is decided.

To determine whether or not development should be started, a technical conference is held in which the President and the heads of the Quality & Environment Issues Department, the Research & Development Department and the RE Design & Development Department of the Engineering & Technology Center, the Marine Engineering Department and sales department of the Marine Power System Business Division, the Plant Engineering Department and the sales department of the Power System Plants Business Division, the Production Center, and the Procurement Center participate.

2 Basic design, performance evaluation, and cost estimate evaluation

After the decision to start development is made, in the basic design, performance evaluation, and cost estimate evaluation phase, the RE Design & Development Department sets the development objectives, sales targets, sales price targets, manufacturing cost targets, major specifications, major performance, development plans, etc., in consultation with the Marine Power System Business Division or the Power System Plants Business Division. When setting the major performance, the RE Design & Development Department is required to describe the targets of the major performance in the Targets and Records Table of Key Performance. The major performance targets include the fuel consumption rate and NOx emissions. However, as described above, the target value of the fuel consumption rate is already determined in the phase of the decision to start the development of the new engine model. The target value is considered to be the value to be achieved, and since the basic design, performance evaluation, and cost estimate evaluation phase is the phase in which designs, etc. are examined to achieve the target value, the target value is basically not changed in this phase. In addition, the target value of NOx emissions is set to be within the range of the regulation value. The review members evaluate the target performance (including fuel consumption rate and NOx emissions) and other items set in this way. Basically, however, the evaluation of target performance is not significantly different from the evaluation in the development start evaluation described in 1 above.

Based on this, a technical conference is held to conduct basic design and performance evaluation, cost estimation and evaluation, and re-evaluation of the set targets, and to determine whether or not to start detailed design and technical evaluation.

3 Commercialization design and mass production cost evaluation

After the decision to start detailed design and technical evaluation, the RE Design & Development Department carries out detailed design. In this phase, the target performance can be reviewed as necessary, and the review members reconfirm the Major Performance Targets and Results table, and if it becomes necessary to change the set targets, the review members evaluate it. In practice, however, there are basically no new circumstances arising in this phase that were not previously assumed, and since further studies will be conducted to achieve the target values of the fuel consumption rate, etc., these values will basically not be revised in this phase.

Based on this, a technical conference is held to evaluate the profitability of the development and determine whether or not to start production of the prototype.

4 Beta version delivery evaluation

After the decision to start production of the prototype is made, the RE Design & Development Department develops the prototype, orders the Production Center to manufacture the prototype, and then the RE Design & Development Department and the Research & Development Department carry out test operation[15]of the prototype to confirm its performance, calculate the actual values of fuel consumption rate, etc., and enter them in the Major Performance Targets and Results table. Test operations of the prototype are conducted by the Engine Performance Technology Group of the Research & Development Department and the group in charge at the RE Design & Development Department. The test operations themselves are conducted by employees of each of the above groups. The tests are conducted daily by changing parameters (for example, fuel injection timing, turbocharger specifications, engine cam timing, etc.), and the results (including fuel consumption rate) are entered in Excel sheets. In calculating the actual value of the fuel consumption rate, heating value correction, specific gravity correction, drain amount correction, and ISO correction are carried out. The calculation formula (including ISO correction) is built in the above Excel sheets in advance, and the fuel consumption rate is automatically calculated when the measured fuel consumption[16] and other values are input. The parameters are determined after the above daily measurements, and the actual values of the fuel consumption rate, etc. are determined. Daily measurement data are rarely checked by the group leaders or the General Manager of the RE Design & Development Department, but the group leaders discuss the content of the tests to be done next and the determination of parameters as appropriate. The test operations of the prototype are carried out over a period of six months to one year, and the actual values of the prototype are determined. If the target value cannot be achieved in the beta version delivery evaluation, in principle, the design will be reviewed to achieve the target value,

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[15] The Engineering & Technology Center has test facilities called test bench at the Ohta Plant but does not have any facilities at the Niigata Engine Plant, which has only test operation bench owned by the Production Center. When tests are conducted at the Niigata Engine Plant, the Engineering & Technology Center rents the test operation bench of the Production Center. It is not generally decided which plant will carry out manufacturing and test operations of the prototype. In some cases, development is carried out at a plant that manufactures an existing engine similar in performance to the prototype. In other cases, the plant may be selected depending on the availability and the busyness of both plants.

[16] Fuel consumption can be measured either by volume (L/h) or by weight (g/h), depending on the measuring instrument. When the amount (L/h) is measured, the weight (g/h) is calculated by multiplying the specific gravity.

and the tests will be conducted again to confirm. Based on the actual values determined in this way, the review members reconfirm the target performance (including fuel consumption rate and NOx emissions) and other items.
On this basis, a technical conference is held, and a technical evaluation (including required specification achievement), etc. are conducted to determine whether or not to proceed with commercialization (beta version delivery). There can be some cases where the target value is not achieved in this phase, and it is reflected in the specification values set with the customer.

5 Development completion and mass production transition evaluation

A technical evaluation and cost estimation and evaluation are to be conducted approximately one year after the beta version is delivered and put into actual operation. Regarding performance, engine conditions during field operation and long-term operational data, which cannot be confirmed by test operations at the plant, are to be collected and evaluated, and a technical conference is held to determine the completion of development.

6 Mass production model evaluation

Approximately one to two years after the completion of the beta version evaluation, the performance of mass-produced products is evaluated by collecting engine conditions during field operation and long-term operational data, which cannot be confirmed by test operations at the plant, and a technical conference is to be held to conduct a comprehensive evaluation including performance.

7 Summary

As described above, in the development of new engine models, the development target values were set in the initial phase of development. The development process was roughly divided into six phases, and technical conferences were held in each phase to confirm the degree of achievement of the development target values and to judge the transition to the next phase.

However, there is no QMS, such as development criteria and manuals, to consider various margins (seasonal differences, performance variations in mass-produced products, and measurement errors) in setting development target values for fuel consumption rate. Therefore, these margins were not fully included in the development target values, and the development target values were basically not lowered in the later phases. As for the target value of the fuel consumption rate, the Engineering & Technology Center determined the specific target value based on the data collected by the sales department, and the specific role of the Quality & Environment Issues Department was not specified.

Furthermore, regarding the development target values such as the fuel consumption rate, which were set in the development start evaluation phase, there were no transition judgment criteria to determine the degree of test results required to proceed with the next phase in the performance test at the development phase, and there were no standards such as the method of resolution in the technical conference. Therefore,

transition judgment to the next phase was conducted without sufficient consideration of margins. In addition, although the Quality & Environment Issues Department participated in technical conferences, the specific role of the department in judging the transition to the next phase had not been specified.

(B) Business processes in the mass production phase

1 Business process for system design management and determination of fuel consumption rate specification values

For the beta and mass-produced engines, the Marine Engineering Department of the Marine Power System Business Division manages the system design of marine engines, and the Plant Engineering Department of the Power System Plants Business Division manages the system design of land-use engines. System design management refers to the design for engines that have already been developed, such as how to install the engine on the ship hull and what auxiliary equipment to use when proposing and delivering the engine to customers. The catalog values including fuel consumption rate (also called nominal fuel consumption) have already been determined for the developed engine, but the catalog value of fuel consumption rate is the basic fuel consumption rate of the engine[17]. Therefore, the specification value of the fuel consumption rate agreed with the customer in each project will vary according to the engine specification in the project. The specification values of fuel consumption rate are determined by the Engineering & Technology Center based on the catalog values after obtaining engine specification information for each individual project from the Marine Engineering Department of the Marine Power System Business Division or the Plant Engineering Department of the Power System Plants Business Division. The business processes are basically the same for both marine engines and land-use engines[18]. Hereinafter, the outline of the business process of system design management and determination of the fuel consumption rate specification value in the case of marine engines will be described.

(1) Inquiry design

First, the sales department of the Marine Power System Business Division obtains engine specifications and other information from customers, creates an inquiry information document (specification confirmation list), and provides the list to the Marine Engineering Department. The inquiry information document (specification confirmation list) does not include values for engine fuel consumption rate or NOx emissions. The Marine Engineering Department checks each specification item and whether or not there are any unclear points based on the relevant inquiry information document (specification confirmation list) and discusses with the sales department and customers as necessary to determine whether or not to conduct a

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[17] IPS refers to this value as the catalog value of fuel consumption rate or nominal fuel consumption, but this value is not listed in the engine catalog.

[18] However, in the case of marine engines, the Marine Engineering Department of the Marine Power System Business Division issues production orders to the Production Center, while in the case of land-use engines, the RE Design & Development Department of the Engineering & Technology Center issues production orders to the Production Center.

design review[19]. In the case of overseas customers, a contract is concluded in the phase of this inquiry design, and the contract is accompanied by a Technical Specification that describes specification values such as fuel consumption rate, etc. If it becomes necessary to change the contract amount due to changes in specifications, etc., the contract will be revised.

After that, the Marine Engineering Department prepares product specifications and various drawings to be submitted to the customer, and when the customer accepts the above specifications, etc., the Marine Engineering Department performs estimation work. When the Marine Engineering Department performs such estimation work, it prepares the estimate specifications of the equipment to be procured and requests the Procurement Center to obtain estimates of the equipment to be procured. The Marine Engineering Department prepares an estimated cost notice based on the estimate of equipment obtained by the Procurement Center and submits the notice to the sales department. The sales department examines the acceptance of orders based on the relevant notice, and if it determines that an order can be accepted, prepares a request for approval for order promotion and submits the request for approval to the Profit Control Department of the Administration Division. When the Profit Control Department approves an order, it notifies the Production Center to that effect, and the Production Center issues a sequentially numbered notice to determine the acceptance of order.

(2) Determination of system design and fuel consumption rate specification values

After determining an acceptance of order, the Marine Engineering Department prepares a design plan that describes (a) product name, delivery date, design schedule, and design period, (b) person in charge, and (c) specific design items in order to manage the system design business process, and then examines the necessity of a specification meeting with the customer. When it is necessary to have a specification meeting with the customer, the Marine Engineering Department prepares a specification document and meeting documents, and then conducts a design specification meeting with the customer, revises the specification document as necessary, and the customer approves the specification document. In some projects, it may be necessary to change the specifications at the request of the customer after the specifications have been approved. In this case, the sales department prepares a specification change notice and contacts the Marine Engineering Department, who then confirms and reviews the contract.

After that, the Marine Engineering Department prepares a specification confirmation checklist, and

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[19] In the design review, IPS discusses whether it is a project possible to receive an order in the first place, how to install the engine, and so forth. The criteria for determining whether a design review should be held are (a) 3H (Hajimete (first time), Henkou (change), and Hisashiburi (first time in a while)), (b) whether or not there is a problem in meeting the delivery date of the project, and (c) whether or not there is a risk of non-conformance occurring after service. The leader of each group in the Marine Engineering Department determines whether or not a design review should be held. (a) "Hajimete (first time)" includes, for example, the case where the ship hull to which the engine is installed is the first ship hull to which the engine is adopted. (b) applies to projects with short deadlines and scheduling problems. For (c) for example, if a ship is required to carry a relatively small engine that is not normally delivered to a large ship, it may be judged that there is a risk of non-conformance. In the design review, the general managers for important projects or the group leaders and subordinate employees for less important project from the sales department of the Marine Power System Business Division, the Reciprocating Engine Assembling Department of the Production Center, the Quality Control Department, the RE Design & Development Department of the Engineering & Technology Center, the Procurement Center, the Quality Control Department of the Marine Power System Business Division, etc. will participate.

checks the items in the checklist with the sales department and the customer as necessary[20]. In the specification confirmation checklist, (a) model, number of units, output power, rotational speed, rotational direction, installation location, (b) scope of order received, scope of customer supply, (c) application of special laws and regulations, (d) non-standard inspection and test requirements, (e) non-standard documents to be submitted, etc., are to be described, but specification values of fuel consumption rate are not to be described. Then, the Marine Engineering Department prepares the estimated cost notice and equipment order specifications, and the Procurement Center selects the manufacturer to order the equipment and submits the cost and drawings to the Marine Engineering Department[21].

After that, the Marine Engineering Department prepares the delivery documents (including delivery specifications) and submits them to the customer, amends them as necessary, and obtains the customer's approval. The delivery documents also contain the specification value of the fuel consumption rate, which is determined by the Marine Engineering Department based on the catalog value after obtaining the specification information of the engine in the project. Depending on some specifications, the specification value of the fuel consumption rate is determined after consultation with the RE Design & Development Department. In the case of customers in Japan, the time to submit delivery documents (including delivery specifications) and the time to conclude a contract differ depending on the customer and the project. However, if the customer concludes a contract after approving the delivery documents, it is considered that there are cases where the specification value of fuel consumption rate is agreed with the customer in this phase.

After that, the Marine Engineering Department prepares the construction documents and the completed documents and registers them in the internal system, the Engine Archive. In addition, in parallel with the preparation of construction documents, the Marine Engineering Department revises the estimated cost notice and special remarks, issues the final version of the detailed statement, and checks with the product specifications.

2 Business processes related to manufacturing and inspection

(1) Manufacturing to completion inspection (internal inspection)

After the preparation of the construction documents in 1 above, the Marine Engineering Department of

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[20] After that, the Marine Engineering Department is supposed to prepare a design review matrix and examine the necessity of the design review again, but the design review is rarely held again in this phase. In this phase, a design review is held only when it is necessary to discuss the schedule of an important project, and the specification confirmation checklist is revised as necessary.

[21] In this phase, if the following requirements are satisfied: (a) the specification confirmation rate is 70% or more, (b) in principle, within one month from the date of number issuance, and (c) the specifications have been discussed as the specifications have been decided by the shipyard, the Production Center requests to hold the A meeting (production kick-off meeting). At the A meeting, the Production Planning Department of the Production Center plays the central role and the sales department, the Reciprocating Engine Assembling Department of the Production Center, the Quality Control Department of the Production Center, the Procurement Center, the Marine Engineering Department, the product development department, etc. participate, and they are to explain and review (a) the order acceptance history, (b) the delivery specifications, (c) the overall process, (d) the drawing release management schedule, (e) the production management schedule, and (f) the working budget, and to approve the estimated cost notice.

the Marine Power System Business Division in the case of marine engines or the RE Design & Development Department of the Engineering & Technology Center in the case of land-use engines orders the Assembling Group of the Reciprocating Engine Assembling Department of the Production Center to start manufacturing according to the main engine manufacturing list[22]. In the Assembling Group of the Reciprocating Engine Assembling Department, the Assembling Team assembles the engine based on the main engine detailed statement and prepares the engine assembly checklist[23]. After the engine is assembled, the Test Operation Team of the Assembling Group, Reciprocating Engine Assembling Department makes preparations such as installing the engine for the test operation, performs break-in operation, and measures the performance. Next, the Operation Inspection Team[24] of the same group joins and carries out engine test operations, and the team checks the data and adjusts the performance including the fuel consumption rate.

After that, the Test Operation Team and the Operation Inspection Team carry out the engine completion inspection (internal inspection). The general flow of completion inspections (internal inspections) of marine engines at the Niigata Engine Plant and the Ohta Plant is as follows.

At the Niigata Engine Plant, the Assembling Checklist that the Operation Inspection Team fills in for the completion inspection (internal inspection) has a column for the specification value of the fuel consumption rate and a column for the measured value of the fuel consumption rate, etc., in order to compare the operating performance difference when multiple engines are delivered to the customer. The Operation Inspection Team fills in the specification value of the fuel consumption rate in the Operation Inspection Checklist, and also fills in the measured value of the fuel consumption rate when multiple engines are delivered to the customer[25]. After the pre-shipment test operation, the leader of the Quality Control Group of the Quality Control Department of the Production Center is to confirm and seal the Operation Inspection Checklist. In the completion inspection (internal inspection) at the Niigata Engine Plant, the “Load Test Result Table” and the “Fuel Consumption Calculation Sheet” are also prepared by hand, and the values of fuel consumption and fuel consumption rate are recorded in the “Fuel Consumption Calculation Sheet.” Additionally, if a customer requests the results of the completion inspection (internal inspection), the “Shop Test Report (Internal Test)" related to the completion inspection (internal inspection) is prepared, and the values of fuel consumption rates are recorded. At the Niigata Engine Plant, the “Shop Test Report (Internal Test)" are not confirmed by the inspection supervisor of the Quality Control Group of the Quality Control Department of the Production Center, and they are stored together with the handwritten "Load Test Result Test" and "Fuel Consumption Calculation Sheet.

At Ohta Plant, for example, the Operation Inspection Checklist[26] for the ship main engine has a column for the specification value of fuel consumption rate and a column for the measured value of fuel consumption rate, etc., in order to compare the operating performance difference when multiple engines

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22 The main engine detailed statement contains the specification value of the fuel consumption rate.

23 The engine assembly checklist does not contain items related to fuel consumption rate.

24 Hereinafter, in the Assembling Group of the Reciprocating Engine Assembling Department, the department that conducts engine test operations and checks and adjusts engine performance is referred to as the “**Operation Inspection Team**,” and the person in charge of these duties in that department is referred to as the “**Operation Inspector**.”

25 The same applies to land-use engines.

26 At the Ohta Plant, it is officially called “Operation Inspection Check Sheet.” However, in this report, it is described as “Operation Inspection Checklist” in conformity with the format of the Niigata Engine Plant.

are delivered to the customer. The Operation Inspection Team fills in the specification value of the fuel consumption rate in the Operation Inspection Checklist, and also fills in the measured value of the fuel consumption rate when multiple engines are delivered to the customer[27]. On the other hand, some Operation Inspection Checklists, such as the Operation Inspection Checklist for low-speed engines, have a column for the specification value of fuel consumption rate, but do not have a column for the measured value. The leader of the Quality Control Group of the Quality Control Department of the Production Center is to confirm and seal the Operation Inspection Checklist. “Load Test Result Table” and “Fuel Consumption Calculation Sheet” are not prepared during the completion inspection (internal inspection) at the Ohta Plant. At the Ohta Plant, when a customer requests submission of the results of a completion inspection (internal inspection), a “Shop Test Report (Internal Test)” related to the completion inspection (internal inspection) is prepared, and the values of fuel consumption rates are recorded. The inspection supervisor of the Quality Control Group of the Quality Control Department of the Production Center is responsible for confirming and sealing the "Shop Test Report (Internal Test)" at the Ohta Plant.

(2) Pre-shipment test operation

After the completion inspection (internal inspection), the Operation Inspection Team of the Assembling Group of the Reciprocating Engine Assembling Department of the Production Center prepares the pre-shipment test operation and various inspection records. Pre-shipment test operation is a pre-shipment inspection attended by classification inspectors from the classification society, shipyard personnel, and shipowner personnel. The Quality Control Group of the Quality Control Department of the Production Center is in charge of dealing with the classification inspectors in pre-shipment test operation. The inspection work is carried out by the Test Operation Team of the Assembling Group of the Reciprocating Engine Assembling Department and the Operation Inspection Team of the same group. When recording the test data and preparing the Shop Test Report (Test Record), the Operation Inspection Team reads the flow rate of the fuel flow meter, and takes notes of the read values[28]. The Operation Inspection Team records the values in the Shop Test Report (Test Record) with a PC based on the notes and completes the Shop Test Report (Test Record) after checking the consistency of the data and performance[29]. Shop Test Report (Test Record) consists of the major specifications table, engine adjustment table, plant oil condition table, load test result table, engine performance curve, remote control device and protective device test result, crankshaft deflection, and public test result judgment table. The fuel consumption rate is described in the load test result table, engine performance curve, and public test result judgment table.

Thereafter, the group leader of the Assembling Group approves the relevant Shop Test Report (Test Record) and submits the relevant Shop Test Report (Test Record) to the classification inspector and the customer after being confirmed by the chief inspector of the Quality Control Group of the Quality Control

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27 The same applies to land-use engines.

28 At the Ohta Plant, the Operation Inspection Team reads the pressure and the temperature, in addition to the flow rate of the fuel flow meter. On the other hand, at the Niigata Engine Plant, the Operation Inspection Team reads the flow rate of the fuel flow meter, and the Test Operation Team reads the others and gives the handwritten note to the Operation Inspection Team.

29 Basically, Japanese customers do not require to confirm or submit the above notes in which measured values are handwritten, but overseas customers may require to submit the notes.

Department of the Production Center[30].

(3) Shipment

After completion of the pre-shipment test operation, the product is shipped. The fuel consumption rate of marine engines is not evaluated after installation on a ship because it is impossible to measure the fuel consumption rate of a single engine after installation on a ship due to the hull performance and weather conditions, etc. However, the fuel consumption rate of land-use engines is evaluated as a plant after installation on site, in the test operation. In this evaluation, the employees of the Test Operation Team of the Assembling Group of the Reciprocating Engine Assembling Department measure the fuel consumption rate, etc., at the customer's plant, and the staff of Plant Construction Department of the Power System Plants Business Division prepares a test result table, and after obtaining the approval of the general manager of the department, submits the test result table to the customer.

(4) Verification of NOx emissions

Inspection regarding NOx emissions (hereinafter referred to as "**NOx emissions verification**") is carried out by the classification society (Nippon Kaiji Kyokai (ClassNK) in the case of Japan). The NOx emissions verification is carried out only for the first unit (parent engine). For the series engines of the parent engine (member engines) that meet the prescribed requirements, only verification of the parameters by checking internal inspection records is carried out, and the NOx emissions verification itself is not carried out. The Reciprocating Engine Assembling Department of the Production Center and the Quality Control Group of the Quality Control Department of the Production Center are in charge of the NOx emissions verification, but the Engineering & Technology Center may also be present.

[30] In case of land-use engines, it is confirmed by the group leader of the Quality Control Group.

IV The misconduct

(A) Misconduct in pre-shipment test operations

1 Alteration of fuel consumption and fuel consumption rate

For marine engines and land-use engines, there are cases where the fuel consumption rate has been agreed upon as the specification value with the customer. In the pre-shipment test operations described in III(B)-2(2) above, the Operation Inspectors of the Assembling Group of the Reciprocating Engine Assembling Department of the Production Center at the Niigata Engine Plant and the Ohta Plant intentionally altered the value measured in the pre-shipment test operations in the test reports and submitted them to the customer. Specifically, (a) when the measured value of the fuel consumption rate does not meet the specification value agreed with the customer, the fuel consumption and the fuel consumption rate are altered in order to keep them within the specification value, and (b) when the measured value of the fuel consumption rate meets the specification value agreed with the customer but there is a discrepancy between the fuel consumption rate data of the same engine delivered to the customer in the past, or when two or more engines of the same type are delivered to the customer at the same time, there is a discrepancy between the fuel consumption rate data of those engines, there were cases in which the fuel consumption and the fuel consumption rate were altered in order to avoid explaining the discrepancy to the customer[31].

In case where the measured value of the fuel consumption rate does not meet the specification value in the completion inspection (internal inspection) conducted before the pre-shipment test operation, the status of recording of the measured value of the fuel consumption rate and the record of the fuel consumption rate after alteration are as shown in the table below.

[31] In addition, when two engines of the same type were delivered to a customer at the same time, if there was a discrepancy in the data of the temperature and pressure of the secondary coolant and the pressure of the fuel between those engines in the pre-shipment test operation, there were cases that these data were altered in order to avoid explaining the discrepancy to the customer. Some customers of the Ohta Plant and the Niigata Engine Plant requested to correct the fuel consumption rate based on a certain conversion formula, taking into account the difference between the atmospheric conditions in the pre-shipment test operations and those where the engine is used. Of the items subject to the above alteration, the secondary coolant temperature is used in the conversion formula, so if it is altered, the fuel consumption rate after the conversion will be affected. However, according to IPS, the alteration of the secondary coolant temperature is considered to have only a minor effect on the fuel consumption rate.

[Status of Records in Completion Inspection (Internal Inspection), etc.]

	Niigata Engine Plant	Ohta Plant
Recording of measured values and retention of records	• The measured values were recorded in the “Load Test Result Table” and the “Fuel Consumption Calculation Sheet” and retained. • When multiple engines were delivered to a customer, measured values were also recorded in the Operation Inspection Checklist and retained.	• If it is necessary to submit the Shop Test Report (Internal Test) to the customer, the measured values are recorded on an Excel sheet titled "Fuel Consumption Measurement Results (Confidential)" and retained. In other cases, the records of the actual measured values are not retained[32].
Recording of altered fuel consumption rates	• When the customer requested the submission of the Shop Test Report (Internal Test), altered fuel consumption rates were recorded in the Shop Test Report (Internal Test) and retained.	• When the customer requested the submission of the Shop Test Report (Internal Test), altered fuel consumption rates were recorded in the Shop Test Report (Internal Test) and retained. • When multiple engines were delivered to a customer, altered fuel consumption rates were recorded in the Operation Inspection Checklist and retained.

In case where the measured value of the fuel consumption rate does not meet the specification value in the pre-shipment test operation, the status of recording of the measured value of the fuel consumption rate and the record of the fuel consumption rate after alteration are as shown in the table below.

[Status of Records in Pre-shipment Test Operation, etc.]

	Niigata Engine Plant	Ohta Plant
Recording of measured values and retention of records	• The measured values were recorded on a document called “RA sheet” and retained.	• The measured values were recorded in an Excel sheet titled “Fuel Consumption Measurement Results (Confidential)” and retained.
Recording of altered fuel consumption rates	• Altered fuel consumption rates were recorded in the Shop Test Report (Test Record) and retained.	• Same as the left

[32] Note that, when multiple engines were delivered to a customer and the measured values of the fuel consumption rate met the specification value, measured values were recorded in the Operation Inspection Checklist and retained.

2 Inappropriate measurement of fuel consumption

In the pre-shipment test operation, some customers of the Niigata Engine Plant requested to check the flow meter which measured the fuel consumption. In this case, since the customer also knew the fuel consumption, if the fuel consumption and fuel consumption rate were altered, it was considered that there was a possibility that the alteration would be discovered by the customer. Therefore, the Operation Inspectors of the Niigata Engine Plant sometimes recorded a lower fuel consumption rate than the actual value in the test reports by measuring the fuel consumption by an inappropriate method as described below.

Specifically, the Operation Inspectors at the Niigata Engine Plant changed the coefficient of the digital flow meter so that the fuel flow rate displayed on the flow meter was lower than the actual fuel flow rate, making the fuel consumption rate appear lower than the actual value.

In addition, the Operation Inspectors of the Niigata Engine Plant opened the valve installed in the line that bypassed the fuel flow meter of the fuel supply system and operated the valve so that the fuel also flowed in from the bypass line. As a result, the fuel flow rate displayed on the fuel flow meter became smaller than the actual fuel flow rate, and the fuel consumption rate appeared lower than the actual value.

(B) Alteration of fuel consumption rate in NOx emissions verification

As described in III(B)-2(4) above, NOx emissions verification may be carried out for marine engines and land-use engines. The Operation Inspectors of the Niigata Engine Plant had intentionally altered the value of the fuel consumption rate measured in the test operation in NOx emissions verification to match the catalog value in the test reports and submitted them to the classification society. The reason for this was that low-speed engines, the major models at the Niigata Engine Plant, often exceeded the specification value of the fuel consumption rate in order to satisfy the NOx regulation value, and the fuel consumption rate measured at the time of the NOx emissions verification was altered so as not to cause a discrepancy because of concern that the fuel consumption rate measured at the time of the NOx emissions verification would be communicated to the customer and compared with the fuel consumption rate at the time of pre-shipment test operation[33] [34].

On the other hand, at the Ohta Plant, the alteration of the fuel consumption rate in the NOx emissions verification was not confirmed, as was the case at the Niigata Engine Plant. The background to this was that the fuel consumption rate of the medium-speed engines, the major models of the Ohta Plant, did not exceed the specification value even if it was operated in compliance with the NOx regulations.

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[33] In addition, in the NOx emissions verification, there were cases in which the values necessary for the calculation of NOx emissions other than the fuel consumption rate (specifically, atmospheric temperature, atmospheric humidity, etc.) were altered. At the Ohta Plant, alteration of the values required for calculation of NOx emissions other than the fuel consumption rate was not confirmed.

[34] Note that it was not confirmed that the fuel consumption rate values required for calculating NOx emissions were altered to obtain an Engine International Air Pollution Prevention Certificate (EIAPP Certificate) when NOx emissions exceeded regulated values.

(C) Concerns raised by some employees regarding the misconduct in the past

As described below, in the past, some employees raised concerns about the misconduct, but no specific actions were taken after that.

For example, in 2016, an Operation Inspector sent an e-mail to 11 officers and employees of the Reciprocating Engine Development Group of the Engineering & Technology Center, the Marine Engineering Group of the Engineering & Technology Center, and the Quality Control Group of the Production Center at that time, as well as the officers and employees and other Operation Inspectors of the Reciprocating Engine Assembling Department of the Production Center in the CC, stating that: there were many cases in which the fuel consumption rate of the mass production of some engines did not meet the specification value; it was necessary to take measures such as reviewing specification values and improving engine performance so as not to repeat the case of fuel efficiency falsifications in the automobile industry; the Operation Inspection Team had taken all possible measures, and it had exceeded the range that could be adjusted in the test operation; according to the news report of the cases of other companies, it seemed that the manufacturing floor was held responsible, but the manufacturing floor should not be held responsible for the alteration of the fuel consumption rate; and the development department or design department should consider the response. The e-mail was sent together with the data that showed the deviation of the fuel consumption rate from the specification value, but no special measures were taken afterwards.

In addition, in 2018, an Operation Inspector sent an e-mail message to four officers and employees of the sales department and the Marine Design Group of the Technology Center at that time, as well as the officers and employees and other Operation Inspectors of the Product Development Group of the Engineering & Technology Center, the Marine Design Group of the Engineering & Technology Center, and the Reciprocating Engine Assembling Department of the Production Center in the CC, stating that the fuel consumption rate of a specific engine did not meet the specification value and that they should notify to the customer that the specification value of the fuel consumption rate should be reviewed. However, the officers and employees of the sales department who received the above report replied to the Operation Inspector that: they could not easily change the fuel consumption rate that had already been provided to the customer; they would like the plant to consider a response; and they would like the plant to adjust the engine and bring the measured value into the range of the specification value by any means. Although the e-mail was shared with other sales department officers and employees, no special action was taken by the sales department.

In addition to the above, four Operation Inspectors or former Operation Inspectors stated in the interview with the Committee that, between around 2003 and 2016, they had informed the design department staff or the development department staff that the fuel consumption rate did not meet the specification value several times by e-mail or verbally. However, they were told for example, “Don’t send me this in writing.” They also talked to their superiors, but they were told for example, “There’s nothing we can do about it because the specification value is fixed. We can’t sell it with the measured values,” and no special action was taken. In addition, one of the design department staff stated at the interview with the Committee that he had received reports from the Operation Inspectors that the fuel consumption rate did not meet the specification values as described above several times, and that although they had reported the reports to the assembly

department and the development department each time, they had only received responses such as collecting more data parameters, and that no specific measures were taken for improvement.

V The Committee's analysis of the causes and recommendations on measures to prevent recurrence

In addition to the internal investigation report of IPS, the Committee makes the following recommendations regarding the cause analysis and recurrence prevention measures.

(A) Factors that led to the continuation of the misconduct over a long period of time and that it was not rectified internally even though many officers and employees were involved and aware of it

The misconduct has been committed for a long period of time, and despite the fact that at least several dozen officers and employees, mainly those who had experience as Operation Inspectors, had been involved in the misconduct or had been aware of its existence, no voices were raised from among officers and employees to raise concerns, or even though some voices were raised to raise concerns, such voices were not received within the company and the misconduct was not corrected. The misconduct continued even after an inappropriate incident was discovered in relation to IHI's commercial aero engine maintenance business in 2019.

The Committee considers the factors as follows.

First of all, while the misconduct was widely conducted in relation to marine engines[35], which are the main product of IPS, Niigata Engineering, the predecessor of IPS, went bankrupt in 2001 and filed for application under the Corporate Reorganization Act, and the officers and employees involved in the misconduct at IPS (basically, they spent their entire careers with IPS) believed that if they raised concerns about the misconduct within the company, the production of marine engines, etc. would be stopped, the engines and turbines business itself would be abolished, and IPS would be on the verge of going bankrupt again. It is probable that because "the problem was too big" and they wanted to protect "their company" (refers to the engines and turbines business succeeded from Niigata Engineering. The same applies hereinafter.), they hesitated to raise concerns and rectify the problem[36].

It is probable that, even when some people raised concerns, not only the manufacturing department but also the development and design department and the sales department etc. did not take corrective measures such as improving engine performance or reviewing catalog and specification values for the same reason,

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35 Since 2003, the marine power system business has generated approximately JPY 10 to 40 billion in sales, accounting for approximately 30 to 50% of total IPS sales.

36 In the interviews conducted by the Committee, most officers and employees cited the magnitude of the problem and the impact of the company's going out of business as factors.

such as the magnitude of the problem[37].

At the Niigata Engine Plant and the Ohta Plant, managers were rarely transferred from other divisions of IPS or from other IHI Group companies, and senior employees when one joined the company were often promoted to managers, sometimes becoming organizational leaders and even senior management. Under such circumstances, employees who had experienced or recognized and accepted the misconduct were often promoted to manager, and sometimes organizational leader, and even senior management. For this reason, it seems that employees in the field were not able to raise their voices because they thought that it was easy to justify that it was not a serious problem or that it was inevitable in order to protect "their company" because the management was involved in and acquiesced in the wrongdoing, or that they could not expect to rectify the problem even if they had an awareness of it.

In addition, the senior management should have taken notice of the heightened awareness of quality compliance in society and promptly corrected the misconduct before it became a major problem. However, as stated above, the senior management failed to respond to such changes in the social situation and acquiesced to the misconduct. As a result, it is considered that the opportunity for early correction was lost, and this was a major factor in the continuation of the misconduct for a long period of time.

In addition, in the past, executives from IHI held important positions such as the President of IPS, but the officers and employees originally employed by IPS did not raise the issue of the misconduct to the President of IPS, etc., including executives from IHI. It must be said that there was a disassociation between the management of IPS and the workplaces in this regard. One of the reasons for this disassociation seems to be that, from the viewpoint of the officers and employees originally employed by IPS who were involved in and aware of the misconduct, they felt a barrier between them and the President, etc. from the parent company who were very strict about compliance and would be replaced in a few years and that they could

[37] In addition, after the discovery of an inappropriate incident in IHI's commercial aero engine maintenance business in 2019, IPS also conducted QA activities to visualize inspection workload and capabilities, and to confirm the rules of the approved manufacturers. However, it is probable that the officers and employees involved in the misconduct could not report it to the public due to the magnitude of the problem as described above.

not open up about falsifications[38] [39] [40].

Considering how the misconduct could have been detected and corrected at an early stage in light of the factors mentioned above, it seems that early detection and correction could have been possible if a number of people (not just the senior management such as the President of IPS) had been sent continuously from the "outside" of the IPS engine business divisions, such as IHI headquarters and other IHI Group companies. If there were a certain number of such "outsiders" in the organization, they would not have wanted to protect "their company" even though "the problem is too big" and would have acted in response to the voices raising concerns, and would have been able to report the falsifications directly to IHI and ask for its cooperation, even if senior management had been involved in or acquiesced to falsifications in the past. In cases such as the misconduct, which had been ongoing for a long time and had been involved and recognized by a large number of officers and employees, including not only senior management but also the Quality & Environment Issues Department and the Quality Control Department, it seems that early detection and correction would have been difficult only with a system, no matter how well the internal control system of the IPS was established. In the end, it seems that there was no alternative but to have the eyes of an "outside party."

From the viewpoint of measures to prevent recurrence not only for IPS but also for the entire IHI Group, it is necessary to examine whether there are any problems similar to those that existed in IPS (communication failure within the organization) in plants, business divisions, affiliated companies, etc., and, if there is such a possibility, to overcome them through personnel changes and organizational changes across companies and divisions, etc.

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[38] In 2016, some persons sent an e-mail pointing out the problem to 11 people including officers and employees of the Product Development Group and Marine Design Group of the Engineering & Technology Center. At that time, the President of IPS was a person who spent their entire career with IPS, but the problem was not reported to the President of IPS. According to the results of the interviews conducted by the Committee, the officers and employees of the Product Development Group who received this e-mail were resigned to the fact that the problem was too large to be corrected, and therefore, no one consulted the President or other Directors or Audit & Supervisory Board Members. It is possible, then, that the fact that the President of IPS was an executive from IHI was not such a major factor. However, several officers and employees stated that the separation between the executives from IHI and IPS-born workplaces was one of the factors contributing to the prolongation of the misconduct, which indicates that at least at the IPS workplaces, there was an awareness that it was impossible (or difficult) to consult with the President and other executives.

[39] The question is whether there was any indication that the President, Directors, etc. (except for those involved in or aware of the misconduct), including executives from IHI, were aware of the problem, but no such indication was found based on the results of interviews and examination of materials. At that time, it is a very difficult question to know what the President and Directors, etc. had to do to discover the problem. In addition to drastic personnel changes across departments and companies, it might be possible to visit the plant floor frequently, including the Operation Inspection Team and the Quality Control Department, to see the operation inspection method and receive an explanation from the person in charge, or to receive an explanation from the Quality Control Department staff on what kind of evidence was used to check the Shop Test Report and make shipment decisions. However, the reality of IPS at that time was that they had an initiative where the President visited the Niigata Engine Plant and the Ohta Plant every other month to hear from the employees of both plants. In view of the ratio of alteration and the situation that the operation inspectors were troubled because the values were not within the specification values, it is possible that such opinions could have been heard if the President and Directors, etc. had frequently visited the plant floor and asked in-depth questions, etc. However, in light of the original roles of the President and Directors, etc., this is not considered to be realistic or effective. Therefore, it seems that the right way is to improve and strengthen management methods, such as regular changes in middle management and strengthening quality audits, etc.

[40] As stated in the body text, it is probable that there were various factors that prevented the misconduct from being corrected over a long period of time. In this regard, the weight of each factor seems to differ depending on the period, for example, immediately after 2001, when Niigata Engineering went bankrupt, people were particularly aware that IPS might again be on the verge of going bankrupt. However, the fact that the problem was too big to mention seems to have been the main factor at any period.

(B) Lack of data integrity

As noted in footnote 5 above, as a result of the questionnaire survey conducted at IPS, there were several reports of data alteration, etc., other than the misconduct, although they did not constitute a violation of laws and regulations, and investigations are ongoing. IPS lacked data integrity, and there was a widespread disingenuous belief among IPS employees that if measured values in tests deviated from specification values or were inconvenient values that customers might ask for explanation, the measured values could be altered. This suggests that there was less resistance to altering measured values.

This kind of disingenuous thinking prevailed, and it was not only the production departments that actually carried out the measurements that were less resistant to changing the measured values. As described above, the misconduct was not corrected for a long time, despite the fact that it had been raised many times by the Operation Inspectors. In light of this situation, it is probable that the disingenuous thinking that even if measured values deviated from the specification values, the production departments would simply alter the measured values was prevalent in departments other than the production departments, such as the sales, development, and design departments etc., and that the resistance to altering the measured values had waned.

One of the causes why such disingenuous thinking prevails and resistance to altering measured values has waned in IPS is the low measurement accuracy. For example, in the past, in IPS, when fuel consumption rate was measured, engine power was measured using a water dynamometer and fuel consumption was measured using an analog flow meter. However, the measurement accuracy was low, and the measurement dispersion was large. Since the measurement accuracy was low, the measured value contained an error in the first place and the reliability was low, so it led to justification that altering the measured value was unavoidable in order to correct the error. In addition, even if measured values are initially altered for the purpose of correcting measurement errors, they are gradually altered into unsubstantiated values for the purpose of avoiding explanations to customers, which can be seen in many incidents of quality falsification. At IPS, such a possibility was overlooked, and efforts to improve measurement accuracy such as capital investment were not made for a long time.

Another cause is that the organization as a whole has lost a healthy corporate culture that respects data. This was due to a combination of factors, including the communication failure within the organization mentioned above and the lack of restraining function by the quality assurance and quality control departments mentioned below. One of the factors for this is that the employees received guidance on altering measured values from senior employees immediately after joining the company, and they did not receive appropriate guidance and education on the purpose of inspections and tests, the purpose of recording and retaining the measurement results, and the purpose of explaining and reporting the measurement results to customers, and they were not in a situation where they could understand the purpose and meaning of the work they were in charge of.

As a measure to prevent a recurrence, in order to correct the above-mentioned disingenuous thinking and ensure data integrity, in addition to automating inspections and data recording, strengthening quality audits, etc., continuous efforts should be made to raise the awareness of officers and employees about the importance of quality data by repeatedly providing education on the basic principles and objectives of work,

including on-boarding programs. In addition, in the IHI Group's plants, business divisions, affiliated companies, etc., if there is a department where measurement accuracy seems low or measurement seems difficult, etc., as in the case of IPS, it is possible to consider whether it should be included in the priority targets to detect and prevent quality falsifications.

(C) Lack of sense of crisis among directors and department heads

It is probable that the misconduct could have been corrected by abolishing models with a strict fuel consumption rate specification value and replacing them with the latest models with a margin in the fuel consumption rate specification value. However, some of the officers and employees of IPS were aware of the misconduct before they became department heads or directors but did not take any corrective action as described above even after their promotion.

In recent years, compliance awareness has improved, especially among young employees, and the possibility of whistleblowing about wrongdoing has also increased. In particular, since 2016, fuel efficiency falsifications have become a major problem in the automobile industry with extensive coverage. Directors and department heads should have had a sense of crisis that whistleblowing could lead to a major problem, and should have taken corrective actions, such as working to reduce the cost of the latest models and considering a specific schedule for replacement with the latest models. Despite this, the fact that these officers and employees did not take any specific corrective actions even after assuming the positions of directors and department heads indicates that they lacked the sense of crisis that directors and department heads should have. It is probable that the lack of sense of crisis among the directors and department heads was due to the fact that no complaints were received from customers regarding the fuel consumption rate, and that there was an assumption that the fuel consumption rate of marine engines in particular was greatly influenced by the operating environment and that customers were unable to grasp the correct fuel consumption rate, and that there was a simplistic belief that whistleblowing would not be made in the future.

In light of the above, it is necessary to improve the sense of crisis by reviewing and thoroughly educating senior management on the roles they are expected to play in order to prevent a recurrence in the future.

(D) Closed and vertical corporate culture

At the Niigata Engine Plant and the Ohta Plant, which coincide with the above failure of communication within the organization, senior employees when one joined the company were promoted to managers and organizational leaders, and managers were not transferred from other departments of IPS or from IHI Group

companies[41]. As a result, the organization was closed[42].

Senior employees who experienced or recognized and accepted the alteration of the fuel consumption rate were promoted within the plant and became managers, organizational leaders, and even senior executives. Under such an organizational culture, it would have been difficult to raise the issue of the misconduct.

When the fuel consumption rate did not fall within the specification value by any possibility, the Operation Inspector consulted with the development department staff. However, there was a sectionalism that the development department was responsible for completing the development, and the production department was responsible for keeping the product within the specification value in the mass production phase. Therefore, the problem was not raised officially within the development department, and no organizational improvement was considered. In addition, when the fuel consumption rate did not fall within the specified value by any possibility, the Operation Inspector requested the sales department staff to ask the customer to change the specification value. However, the sales department staff only replied that they wanted the plant to adjust the engine and put the measured value within the specification value by any means possible. It seems that the attitude of the company as a whole to solve the problem was insufficient. It is undeniable that such a vertically divided organizational culture has deprived them of opportunities to identify problems and improve them.

In addition, at the interviews of the Committee, there were statements of both opinions as to whether or not because the development department was in a stronger position than the production department, even if the production department informed the development department that the fuel consumption rate was not within the specification value, no improvements were made, and the production department could not say anything more strongly. . However, it seems to be true that the production department, especially the Operation Inspectors, subjectively perceived the power relationship with the development department as not being taken seriously by the development department and not being able to say anything more strongly to the development department.

In order to improve the organizational culture described above, it is necessary to continue efforts to reform the awareness of officers and employees, as well as trainings to facilitate internal communication, and to further activate the rotation of personnel between departments within IPS and with IHI and its group companies. In addition, at IPS, it is worth examining whether those promoted to senior management, such as directors, are biased toward those from specific departments, such as the development department, and

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41 Regarding the small number of personnel changes in IPS, we have not made a horizontal comparison based on data after positioning IPS and the IPS engine business within the IHI Group as a whole. At the interview, several people pointed out that the number of personnel changes was small and the organization was closed. The reasons for this are thought to have been the fact that Niigata Engineering was the predecessor company and the pride of the brand of Niigata Engineering. Additionally, it was pointed out that there was a period when the power of the labor union was strong in IPS and it was difficult to carry out transfers beyond the workplace or department, and that there was a desire of each department not to transfer talented personnel to another department because the number of personnel decreased after the bankruptcy of Niigata Engineering.

42 In addition, at the interview with the Committee, some officers and employees stated that there was a top-down organizational culture in which they obeyed their superiors and senior employees. As to whether the top-down organizational culture is attributable to IPS-specific factors, it is only pointed out that “The duties of an operation inspector require knowledge and experience that cannot be acquired at universities, etc., and must be acquired through guidance from senior employees in the workplace. In the course of such guidance, a strong senior-junior relationship is fostered.” This, in itself, can be seen to a greater or lesser extent in any business of any company, and is not an IPS-specific factor. However, the fact that the number of officers and employees who point out the top-down culture seems to indicate that at least a certain number of officers and employees think this way about corporate culture.

reviewing the ideal promotion of senior management as necessary. Furthermore, in order to ensure that measures to keep the fuel consumption rate within the specification value are not left to the production department, the content of engine adjustment and the range of adjustment may be stipulated in the internal manual. In addition, the internal manual may clearly state that if the fuel consumption rate does not fall within the specification value even if the production department adjusts the engine, the production department must report it to the relevant department, that the development department must take necessary measures and report the results to the relevant department such as the production department and the quality assurance department, and that the quality assurance department must check whether the relevant process is being properly operated.

(E) The fact that the meaning of the specification value was not accurately understood

In the interviews of the Internal Investigation, there were statements such as: "I was satisfied with my senior's instruction, 'Among product specifications, there are some things we can never compromise and some things we can. Figures that do not affect safety, such as fuel consumption rate, should not be given to customer to avoid unnecessary anxiety.'"; "In order to keep other important specifications (output power, NOx emissions, maximum pressure, exhaust temperature, etc.), fuel consumption rates have to be sacrificed."; and "In particular, since the fuel consumption of marine engines is greatly influenced by the operating environment, the customer would not place importance on the fuel consumption rate in the pre-shipment test operation, and even if the fuel consumption rate was altered, it would not be discovered." Similar statements were obtained at the interviews of the Committee.

As analyzed in the Internal Investigation, this is considered to be an assessment of "Lack of awareness of quality and compliance." However, the Committee considers that the reason why awareness of quality compliance did not work may be that officers and employees did not accurately understand the position of fuel consumption rate. In other words, according to the results of the interviews of the Committee, there were statements that "Although there was a recognition that the fuel consumption rate was a value that had to be cleared in pre-shipment test operation, there was a lack of recognition that it sometimes became the performance ("guaranteed value" in IPS internal terminology) agreed upon in the contract with the customer." and that "Unlike regulation values such as NOx emissions, the specification value of fuel consumption rate was only decided by contract, and it was not considered that it must be absolutely observed. Even if it would be a breach of contract, I thought that it would be a problem to solve by talking to the customer and changing specifications or paying a penalty." This kind of perception that the necessity of complying with specifications and contractually agreed performance is lower than that of the regulation value was observed in the interviews with most of the officers and employees, such as "contractually agreed performance does not have to be complied with, unlike the regulation value, nor as strictly as the regulation value." The difference in the degree of penalty for non-compliance between the regulation value and the specification value does not necessarily mean that the specification value does not have to be complied with. It is probable that the misunderstanding or disregard of the necessity of complying with the specification values, coupled with the sense of security that even if the fuel consumption rate was altered, especially for marine engines, it would not be revealed, led to the wrongdoing for a long time.

As a measure to prevent recurrence in the future, it is conceivable to strengthen education on the correct meaning of specification values, etc. for the entire department related to manufacturing such as the inspection department, the quality assurance department, the quality control department. In addition, in order to create a sense of tension on the plant floor that wrongdoing may be uncovered, the Internal Audit Department and the Quality & Environment Issues Department may conduct quality-focused audits, as indicated in (H) below, and as part of these audits, verify evidence from test results of pre-shipment test operation as a sample.

(F) Inappropriate development target values, unclear transition judgment criteria, etc.

At IPS, it was found that a considerable number of engines did not meet the catalog value of fuel consumption rate and the specification value based on the catalog value. It is probable that there was a problem in that the development was carried out on the premise of setting the catalog value that required alteration of fuel consumption rate at the production site in the first place. Specifically, there was no QMS, such as development criteria and manuals, to consider various margins (seasonal differences, performance variations in mass-produced products, and measurement errors) in setting development target values for fuel consumption rate. Therefore, these margins were not fully included in the development target values. In addition, the development target values set at the phase of the decision to start development were basically not lowered thereafter.

Furthermore, regarding the development target values such as the fuel consumption rate, which were set in the development start evaluation phase, there were no transition judgment criteria to determine the degree of test results required to proceed with the next phase in the performance test at the development phase, and there were no standards such as the method of resolution in the technical conference to judge transition. Therefore, transition judgments up to mass production were conducted without sufficient consideration of the margins.

As described above, the QMS for setting development target values was not established and continuously improved, and the decision to proceed with mass production was made without necessarily satisfying the catalog value of fuel consumption rate at mass production considering seasonal differences and variations in performance. In addition, in order for the quality assurance department to exercise restraining function on quality in determining the development target values and making transition judgments described above, a mechanism should have been established where the quality assurance department played a proactive role so that the development target values were set appropriately, and the transition judgments were made appropriately. At IPS, although the quality assurance department participated in the review held prior to the technical conference and the technical conference, the specific role of the quality assurance department in setting development target values and making transition judgments was not specified.

Based on the above, it is considered that the responsibility of the senior management, who was responsible for the establishment of the QMS and the judgment to proceed with mass production, is heavy. The President, Directors and Executive Officers who attended the technical conference should have been aware of the problem that seasonal differences and performance variations in mass-produced products, etc.,

were not taken into account in setting development target values. A mechanism should have been established so that such variations could be fully taken into account.

Around 2009, it was anticipated that the fuel consumption rate, which was in a trade-off relationship with the NOx emissions, would deteriorate if the NOx emissions were reduced in order to comply with the Tier II NOx regulation for existing engines at that time, and measures to deal with this were considered. At that time, based on the judgment of the head of the Engineering & Technology Center and the head of the sales department and their subordinates at that time, the catalog values of the fuel consumption rate under the Tier II NOx regulation were determined uniformly by increasing the reference value of the previous catalog value (the part of "xx g/kWh" described below) and the indication of margin (the part of "+ x%" described below) in order to avoid that the catalog value of the fuel consumption rate presented to customers would be significantly worse than the previous one from the viewpoint of sales strategy, instead of determining them based on the measured value of fuel consumption rate of each existing engine. Even if changes were made to parts or adjustments were made at the time of test operations, it was expected that it would be difficult to keep the fuel consumption rates of all products within the catalog values after the compliance with the Tier II NOx regulations, in light of the measured values of the fuel consumption rates of the existing engines. However, it appears that the head of the Engineering & Technology Center and the head of the sales department and their subordinates at the time anticipated that, in the event that a product did not fall within the specification values, the Operation Inspectors would alter the fuel consumption rates, as had been the case before.

Based on the above, as measures to prevent recurrence in the future, it is considered that a sufficient margin should be given to catalog values in the setting of development target values in consideration of seasonal differences and performance variations in mass-produced products, etc., the development process such as transition judgment criteria should be clarified so that transition judgments up to mass production can be made with sufficient consideration of the margin, a specific role to be played by the quality assurance department in the development process should be specified, and a process should be formulated so that appropriate responses based on QMS can be made when new laws and regulations are introduced or regulations are strengthened in the future.

In addition, at IPS, because JIS standard[43] stipulates that a deviation of "X+5%" of the fuel consumption rate at rated output is acceptable, the fuel consumption rate was set to "xx g/kWh + 5%," and "+ 5%" instead of "± 5%" was indicated to the customer as the catalog value. In the tests in the development phase, although there were good and bad values depending on the timing of the measurement of the fuel consumption rate, the employees of the development department thought that it would be good if the best value, which is called the champion data, was close to "xx g/kWh + 5%" (for example, + 3%, etc.), and the evaluation by the review members and the technical conference examined whether the fuel consumption rate of "xx g/kWh + 5%" could be achieved or not. Therefore, in the mass production phase, a sufficient

[43] 13.3 of JIS B 8002-1 states that, regarding the fuel consumption rate of reciprocating internal combustion engines, "Unless otherwise stated, a higher consumption of +5 % is permitted for the specific fuel consumption declared at the declared power." In addition, this JIS standard is a translation of ISO 3046-1: 2002, and 13.3 of the ISO standard states the same.

margin could not be secured in spite of seasonal differences and variations in performance. As a result, the upper limit of “xx g/kWh + 5%” was exceeded, and the fuel consumption rate was altered.

In JIS standards, it is considered permissible for the fuel consumption rate to deviate by "+5%" from the rated output, taking into account factors such as seasonal differences and performance variations that occur during the mass production stage. If that is the case, IPS should consider whether the fuel consumption rate can achieve within "xxg/kWh" during the development of new products. The development target value should be set at "xxg/kWh" or "xxg/kWh ±5%", not "xxg/kWh +5%". However, since the catalog value was indicated as "xxg/kWh +5%" and this was set as the development target value, sufficient margin could not be ensured. Given that the catalog value is considered the development target value or its approximate value, it would have been desirable for IPS to clearly indicate to both internal and external parties that "xxg/kWh" is the average practical value of the fuel consumption rate by displaying it as "xxg/kWh" or "xxg/kWh ±5%" in the catalog.

In the interviews by the Committee, there was a statement that the display of the catalog value “xx g/kWh + 5%” was the same for other companies and was, so to speak, an industry custom. However, in view of the fact that this indication was one of the main factors that led to the alteration of the fuel consumption rate together with the inadequacy of the criteria for determining the achievement of the target values in the development phase, if competitors were to set similar development targets, they may find themselves in a similar situation to IPS.

It has recently been reported that competitors of IPS have also been found to have altered its fuel consumption rate and that the Ministry of Land, Infrastructure, Transport and Tourism has conducted on-site investigations, etc. Although the cause of the occurrence in the cases of other companies is not clear, we hope that IPS, in order to continue to lead the marine engine and land-use engine manufacturers industry, will take a lead in raising the issue of the appropriateness of the methods for displaying catalog values and sharing best practices on quality compliance, thereby working to improve quality compliance throughout the industry.

(G) Avoiding explanations to customers

Quality falsifications are often seen in other companies, but it is pointed out that there was a tendency to do anything for customers in the field of marine engines, etc., and there was an atmosphere of not being able to say anything to customers.

It is true that in the misconduct, in order to avoid that the data of the fuel consumption rate of the products delivered in the past and that of the products to be delivered in the future would be different and require explanation to the customer, the Operation Inspectors altered the value in the direction of worsening the fuel consumption rate. Some of them may have been motivated to avoid the disclosure of past misconducts but even if it is troublesome or burdensome, the true customer-focused approach is to thoroughly explain things to customers.

In addition, when the output power at the time of model development is changed according to the customer’s request and delivered, the fuel consumption rate and the NOx emissions change as the output power is changed. Therefore, it is necessary to adjust the parts so that the fuel consumption rate meets the

specification value, and the NOx emissions meet the regulation value. However, the adjustment may not be successful in practice. In such a case, it should have been explained to the customer, the spec should have been lowered, and specification values should have been agreed with the customer in accordance with the actual fuel consumption rate (In fact, according to the results of the interviews, there was a case in which the Operation Inspectors approached the sales staff to lower the spec of the fuel consumption rate and realized it.). However, it seems that there were cases where the misconduct was committed as a result of avoiding such explanation to the customer and agreeing with the customer in accordance with the catalog values of the fuel consumption rate at the time of model development. In addition, when an Operation Inspector informed an employee of the sales department that the fuel consumption rate did not meet the specification value and asked to request the customer to revise the specification value of the fuel consumption rate, the sales staff replied that the fuel consumption rate already communicated to the customer could not be easily changed. The sales staff thought that if it were explained to the customer that the specification value was not met and renegotiated the agreed specification value, the customer's trust and future orders would be lost. However, as is actually done at IPS after the announcement of the misconduct, negotiations to revise the specification values with the customer could have been conducted in consultation with the development and design departments. It is considered that the reason why such a negotiation was not conducted is that the sales department had an attitude to avoid explanations to the customer easily.

In light of the above, it is important to ensure that officers and employees properly engage in explanations to customers as part of future measures to prevent recurrence. For this purpose, it is necessary to consider not only education but also the establishment of a support system for dealing with customers among employees.

(H) Failure of the internal audit, quality assurance, and quality control departments to exercise restraining function

At IPS, the Internal Audit Department and the Quality & Environment Issues Department that directly report to the President, and the Quality Control Department under the control of the Production Center, are departments that are expected to exercise restraining functions on quality.

However, audits by the Internal Audit Department focus on themes that reflect the career and expertise of the General Manager of the Internal Audit Department at the time. In the past few years, audits have been conducted for sales offices, etc. with focus mainly on financial matters, labor relations such as overtime hours, waste disposal status, order reception and sales procedures, and have not focused on quality issues. In addition, about half of the five or so personnel in the Internal Audit Department conducted internal control audits and the other half conducted internal audits.

The Quality & Environment Issues Department recruited personnel from each department to conduct ISO audits to determine whether or not ISO9001 was being complied with. However, it did not conduct audits aimed at detecting individual quality falsification incidents or quality audits to check the quality itself of the products produced at the plant. The Quality & Environment Issues Department was not involved in the preparation and compilation of test results of pre-shipment test operation of each engine, and its

responsibility did not include the management of the plant floor. In addition, the duties of the Quality & Environment Issues Department were disproportionately focused on handling complaints, etc., and there was no mechanism where the department was actively involved in setting development methods and development targets in the development phase.

In the first place, there was a case where a person who had been an Operation Inspector who had altered the fuel consumption rate in the past served as the General Manager of the Quality & Environment Issues Department. In addition, as described in (I) below, the Quality & Environment Issues Department of IPS could be said to have falsely reported to the Quality Assurance Department in the IHI Resources, Energy and Environment Business Area (hereinafter referred to as "**IHI Energy QA**") in cooperation with the Production Center of IPS. At the very least, the Quality & Environment Issues Department of IPS did not fulfill any of its functions.

Furthermore, the Quality Control Department under the control of the Production Center was the final approval department for test reports. However, it did not always attend inspections and tests on the plant floor. Instead, it carried out clerical work at the office attached to the plant. It checked only the data submitted by the Operation Inspection Team and did not check the data against the original data. Moreover, there were many cases in which a former Operation Inspector who had altered the fuel consumption rate in the past belonged to the Quality Control Department, or served as the Quality Control Group leader who was the chief inspector of the pre-shipment test operation and had the final approval authority for the test reports.

As described above, neither the Internal Audit Department nor the Quality & Environment Issues Department focused their audits on the quality problem of the fuel consumption rate not falling within the specification value or the alteration of the fuel consumption rate because of this, and there was no mechanisms where Quality & Environment Issues Department was actively involved in the setting of the development method and development targets in the development phase and the judgment to proceed with mass production. Furthermore, the restraining function of the Quality & Environment Issues Department and the Quality Control Department was insufficient even at the confirmation of test reports after the transition to mass production.

In addition, as more fundamental factors, the individuals involved in the misconduct belonged to the Quality & Environment Issues Department and the Quality Control Department, the Quality & Environment Issues Department confirmed the false report to the IHI Energy QA, and the Quality Control Department instructed to alter the inspection results. Therefore, the Quality & Environment Issues Department and the Quality Control Department were, so to speak, accomplices in the misconduct.

As a measure to prevent recurrence in the future, first, it is important to prevent the Quality & Environment Issues Department and Quality Control Department of plants, subsidiaries, and related companies from becoming accomplices in quality falsification. For this purpose, as mentioned in (A) above, plants, business divisions, and related companies that are concerned about the same problem situation as IPS will require personnel transfers and organizational changes across companies and divisions.

If quality audits are not being conducted as they should be due to staff shortages, the Internal Audit Department and the Quality & Environment Issues Department could be strengthened to conduct quality-focused audits, or they could conduct quality-focused audits from an external perspective or reinforce resources in cooperation with the audit departments and quality assurance departments of IHI and its group

companies.

In order to detect the alteration of quality data such as the misconduct in an audit focusing on quality, it is necessary to consider the efficiency of work and the rationality of work burden. For example, it is possible to collect documents prepared in the process of inspection, including handwritten notes of measured values during inspection, and to compare them with the values of test reports, etc., to conduct e-mail reviews of the audited departments, and to conduct a focused audit, including interviews with persons in charge of inspection for products for which the measured values in the inspection do not have enough margins against the specification or regulation values.

At IPS, an audit notice must be sent in advance for internal audits, and unannounced audits were not conducted. From the perspective of creating a sense of tension among audited departments and preventing inappropriate acts such as this one, it is worth considering the implementation of unannounced audits (includes unannounced audits in terms of audit targets and items) by IHI.

Furthermore, in order to ensure quality, it is required to establish a QMS that the Quality & Environment Issues Department and the Quality Control Department is proactively involved in the upstream process of manufacturing, such as setting development methods and development targets.

(I) Failure of IHI's quality governance

In June 2020, IHI Energy QA instructed its SBUs, including IPS, to conduct quality and compliance education as a horizontal development following the occurrence of incidents of inappropriate quality compliance[44] at IPS. As part of this education, IHI Energy QA instructed its SBUs to identify risks similar to the incidents and to develop countermeasures. In response, in July of the same year, the Assembling Group of the Reciprocating Engine Assembling Department of the Production Center at IPS Ohta Plant wrote in a report that, as a "risk," the catalog value and specification value of the fuel consumption rate of marine engines are indicated as "xx g/kWh + 5%," but the actual fuel efficiency is a value close to the upper limit of "xx g/kWh + 5%," and that it is not unusual that the fuel consumption rate may deviate from the specification value because variations and errors of measuring instruments are not considered at all, and that, as a "countermeasure," it is necessary that the sales departments and engineering departments ask customers to change the indication of the catalog value of the fuel consumption rate because the indication of 5% margin should be included in the measurement error of the production side. The Quality & Environment Issues Department of IPS submitted this report to IHI Energy QA. After that, IHI Energy QA requested the Quality & Environment Issues Department of IPS to confirm the actual situation because the risk would have a significant impact if it actually materialized. Upon receiving a request for confirmation from the Quality & Environment Issues Department of IPS, the Production Center of IPS, without interviewing with the employees at the Assembling Group of the Reciprocating Engine Assembling Department of the Production Center of the Ohta Plant, added to the report an explanation that, as a "risk," the old model marine engines had a small margin of fuel consumption rate, which caused them to be nervous

[44] This refers to an event that was discovered at IPS in 2019 in which, at the request of a customer, land-use parts with the same function as marine parts were shipped, even though the marine parts ware out of stock, without going through the proper shipping procedures, resulting in a state of incomplete records.

during operation, and as a "countermeasure," the fuel consumption rate of the current mainstay model and the new model did not exceed the margin because measurement error and other factors were taken into consideration. However, at that time, the IPS's actual business condition was that the old model was still the mainstay model, and the above revised report, which suggested that there was no problem at present, was nothing more than a false report (the "**Revised Report**")[45]. Subsequently, the Quality & Environment Issues Department of IPS sent the Revised Report to IHI Energy QA by e-mail. IHI Energy QA received the additional report from the Quality & Environment Issues Department of IPS, which contained details that were more regressive than the initial report as mentioned above, but because it received a report from the Quality & Environment Issues Department of IPS, which was in a third-party position, that there were no problems, it believed that the actual situation had been properly confirmed, and did not request further fact-finding. Additionally IHI Energy QA reported to the President and CEO of IHI, who is also the President of the Resources, Energy, and Environment Business Area, as well as to the Vice President of the Resources, Energy, and Environment Business Area, regarding the analysis and countermeasures for the aforementioned quality compliance issues at IPS, as well as the results of the horizontal deployment, which included, as part of the reporting materials, the Revised Report.

As mentioned above, the Production Center of IPS significantly regressed the initial risk recognition statement by adding an explanation to the report that, although the margin was insufficient for older models, the fuel consumption rate does not exceed the margin for the current mainstay models and new models, as if there were no problem at that time. The Quality & Environment Issues Department of IPS must have been aware of the actual business situation of IPS that the older models are still the mainstay models, and knew or could easily have suspected that the content added to the report by the Production Center of IPS was not true. Nevertheless, the Quality & Environment Issues Department of IPS sent the added report to IHI Energy QA without further fact-checking. In view of these circumstances, the Quality & Environment Issues Department of IPS could be said to have falsely reported to IHI Energy QA in cooperation with the Production Center of IPS. At the very least, the Quality & Environment Issues Department of IPS did not fulfill any of its functions. In this regard, the most important thing is to implement measures to enable the Quality & Environment Issues Department to exercise restraining functions, such as personnel transfers across companies and departments, as described above.

From the viewpoint of IHI Energy QA, it would have been desirable to instruct the Quality & Environment Issues Department of IPS to further confirm the facts and clarify the reason for the regression when the IPS Quality & Environment Issues Department submitted the regressive report. Of course, since the Quality & Environment Issues Department of IPS was established as an independent organization in terms of internal structure, it was the role of the Quality & Environment Issues Department of IPS to confirm the actual conditions at the production site of IPS, and it was inevitable that IHI Energy QA would rely on the report from the Quality & Environment Issues Department of IPS while examining risks and countermeasures not only in the IPS engine business but also in various other businesses. However, in order

[45] Many current and former IPS officers and senior management who had not been involved in the misconduct themselves, including those who had worked for a long time in the design and development department, production departments of marine engines, etc., stated that they had no knowledge of the misconduct at all, or that they had been aware of the misconduct but thought that it had ceased to be committed long ago. However, in light of the fact that some employees have repeatedly raised concern about the misconduct to many officers and employees until recently, the credibility of such statements needs to be carefully evaluated on an individual basis.

to learn from this case, it is necessary for the quality assurance department of each business area of IHI, including IHI Energy QA, to ensure the independence and strengthen the human resources of the quality assurance department of each SBU, such as the Quality & Environment Issues Department of IPS. It is also necessary for the quality assurance department of each business area of IHI to enhance sensitivity to indications of quality falsifications, etc. As a measure, it is possible to investigate the reason for the regression if there is a regression in risk reporting from the field as in this case, and to horizontally spread lessons learned from case studies using other cases of quality falsifications, etc., to enhance sensitivity to indications of quality falsifications.

VI Conclusion

At IPS, although it is said to be customer-focused, things inconsistent with the motto were done, such as altering the test results of fuel consumption rate. The factors are as follows.

As IPS, they wanted to display the fuel efficiency of their products well in the competition with other companies, they were proud that the performance of their products was excellent as a whole, and it was difficult to find out the alteration of inspection results, especially for marine engines. Therefore, they believed that it was all right if the champion data that reached the development target came out, and despite the seasonal difference and the variation of performance in the manufacturing process, they displayed the fuel consumption rate with virtually no margin in the catalog. As a result, in the mass production phase, they could not meet the contract specifications without altering the test results of the fuel consumption rate in the pre-shipment test operation. In addition, even if they tried to explain to the customers, they did not have the courage to do so for fear of losing the trust of the customers and they had the psychological and work burden of explaining to the customers head-on. It seems that they have avoided drastic measures and explanations to customers by choosing to be complacent, even though they knew in their minds that the alteration was illegal and would be necessarily exposed at some point.

This may be a rough summary, but a simple summary of the case suggests that IPS is simply pushing its own interest, rather than focusing on the customer.

In the end, as far as the misconduct is concerned, it seems that there was no customer-focused approach at IPS. If officers and employees think that “We focus on our customers,” then it seems that each of them should reconsider whether this is true and what is the true meaning of “For the customer,” and use this case as a benchmark for the future.

In addition, since no one had any intention of committing fraud from the beginning of their employment, they were influenced by an unhealthy organizational culture and gradually began to commit fraud. It must be said that the misconduct has deep roots, because it was recognized by the senior management and even the quality assurance department, who should take the initiative in improving the unhealthy organizational culture and correcting falsifications, and it continued until very recently when the public’s awareness of quality compliance changed drastically. From the perspective of thorough prevention of recurrence and eradication of quality falsifications at IPS, it is considered necessary to change the unhealthy organizational culture from the ground up, such as by focusing on education and continuously holding training and dialogue meetings to change the organizational culture, and to make drastic changes, not small ones, so that

employees can find meaning and importance in their own work. We strongly hope that all officers and employees of IPS will be keenly aware of this and continue to make efforts for reform in the future to ensure that quality compliance prevails.

(END)

Appendix 2

Organization Chart of IHI Power Systems (as of November 1, 2024)