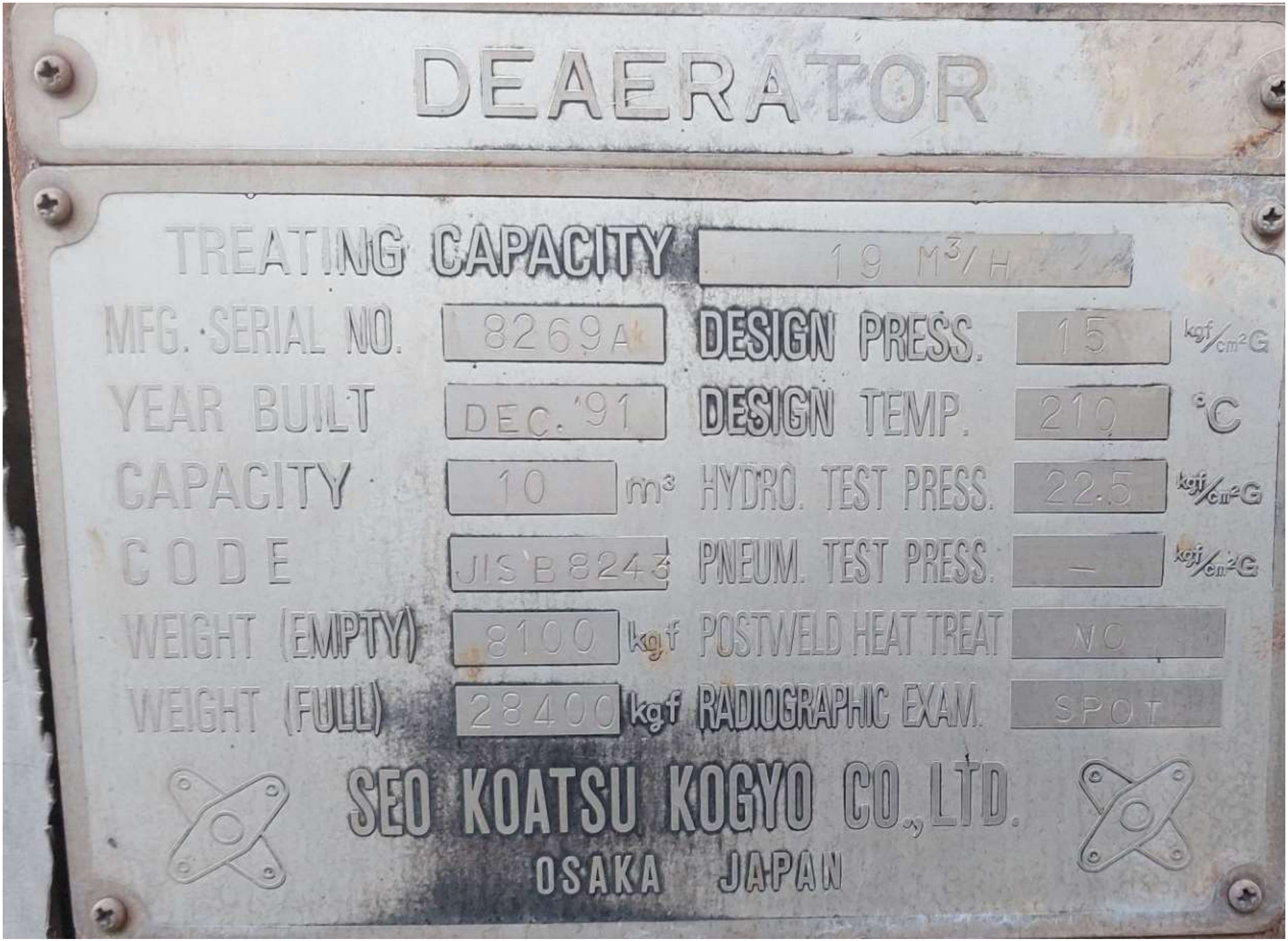

DEAERATOR
TREATING CAPACITY 19 M3/H
MFG. SERIAL NO. 8269A
YEAR BUILT DEC. '91
CAPACITY 10 m3
CODE JIS B 8243
WEIGHT (EMPTY) 8100 kgf
WEIGHT (FULL) 28400 kgf
DESIGN PRESS. 15 kgf/cm2G
DESIGN TEMP. 210 °C
HYDRO. TEST PRESS. 22.5 kgf/cm2G
PNEUM. TEST PRESS. — kgf/cm2G
POSTWELD HEAT TREAT NO
RADIOGRAPHIC EXAM. SPOT
SEO KOATSU KOGYO CO., LTD.
OSAKA JAPAN

INSTRUCTION MANUAL

MITSUBISHI HEAVY INDUSTRIES.,LTD.
NAGASAKI SHIPYARD & MACHINERY WORKS

KM-PROJECT

DEAERATOR

瀬尾高圧工業株式会社
三日市工場
〒586 大阪府河内長野市片添町28番地
TEL 0721－63－5081～7

SEO KOATSU KOGYO CO., LTD.
MIKKAICHI WORKS
28, KATAZOE-CHO, KAWACHI-NAGANO, OSAKA, JAPAN.

(15 PAGES WITH COVER)

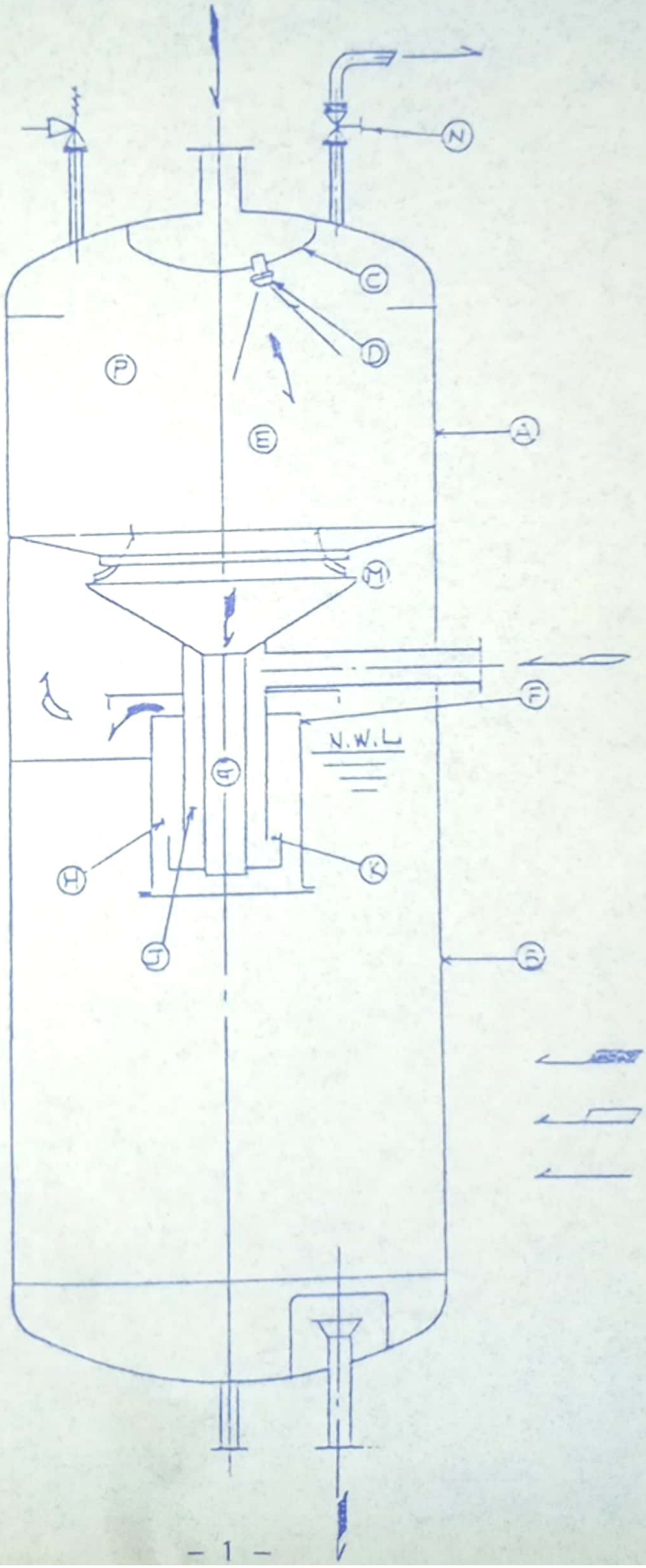
DOC. HISTORY		SECTION: DESIGN SECTION
	SEO MFG. NO. 8269A	CHIEF: T. Yamanari
		DUTY: Y. Hara
	SEO DWG. NO. D91-50865	CHECKED: /
		CHARGED: F. Kamemoto
配布先 客先 白焼 一原 5 1 / 営業 / 東営 / 長営 / 設計 1 / 工務 / 工作 / 品証 / 資材 / 生管 / 見積 / 合計 6	DATE: MAY. 21. '92	DOC. NO. Dz91-50865 ◇0

DATE | SIGN

REL. ATED SECT REVIEW

---CONTENTS---

CONSTRUCTION OUTLINE



2. DESIGN DATA

DESIGN DATA			
TYPE		—	SPRAY & SCRUBBER
DELIVERD CAPACITY		M^3/H	AVE. MAKE-UP REC. R19(=13%)
STORAGED CAPACITY		M^3	10 (at N.W.L)
MAKE-UP WATER INLET TEMP.		°C	90° / 120°
MAKE-UP WATER OUTLET TEMP.		°C	90° / 120°
OPERATING STEAM PRESS.		KG/CM^2G	11
OPERATING STEAM TEMP.		°C	187
O_2 REMOVAL GUARANT		cc/ℓ	0.07
OPERATING PRESSURE		KG/CM^2G	11
OPERATING TEMP.		°C	187
DESIGN PRESSURE		KG/CM^2G	15
DESIGN TEMPERATURE		°C	210
POST-WELD HEAT TREATMENT		—	NO
RADIOGRAPHED		—	SPOT
JOINT EFFICIENCY		—	0.95
CORR. ALLOWANCE		MM	1.0
CODE REQUIRED		—	JIS B8243
HYDR'C TEST PRESS.		KG/CM^2G	22.5
WEIGHT	EMPTY	KG	8100
	OPERATION	KG	18100
	FULL WATER	KG	38450

3. Structure

This deaerator is composed of the upper shell (deaerating chamber) A and the lower shell (water reservoir) B, and is equipped with the water inlet regulator valve, the inside pressure control unit, the water level control unit, the safety valve, the pressure gauge and the thermometer etc. The flow quantity of feed water from the deaerator water pump is automatically controled by the water inlet regulator valve so as to stabilize the water reservoir, and the

feed water is led to the water chamber C.

In the water chamber, 3 spray nozzles D are disposed. The feed water atomized by these spray nozzles enters the first processing chamber E and is heated thereat by steam rising from the second processing chamber F, thus almost all of included air can be separated.

The feed water having been subjected to the first process enters the water cleanning chamber H through the inside descent pipe G. On the other hand, the pressure of heated steam is automatically regulated by the steam regulator valve according to the water quantity so as to stabilize the inside pressure.
The steam is led to the steam chamber J, injected at a high speed from the water nozzle K into the above-mentioned water cleaning chamber, and contacts abruptly with the feed water to cause boiling of water.
Then, the feed water separates the residual air to be blown to an upper side of the water cleaning chamber.

The buffle plate L is installed in the water cleaning chamber so that the steam can be mixed well with the feed water. The steam and air separated thereat enter the above-mentioned first processing

chamber E from the rising port M to heat the feed water. Then, the air and a slight quantity of accompanying steam are released through the vent valve to atmosphere.

The standard water storage of the water reservoir is 10 m^3. The normal water level (N.W.L.) is detected by the water level control unit and the flow-in water quantity is automatically controlled by the feed water inlet regulator valve, so that the water level is always kept at constant. Incidentally, the safety valve is equipped to the deaerator in order to avoid an abnormal rise of inside pressure.
This safety valve is so designed as to release the steam into atmosphere in the event when the inside pressure exceeds 15 kg/cm^2G.

The processed feed water is led to the boiler water pump from the bottom of water reservoir.

4. Operation

When operating the deaerator, put in order and thoroughly clean the deaerator and instruments before commencing the work. Further, pay attention to the arrangement around the instruments even during operation.

4-1 Preparation before starting

A. Clean the deaerating chamber and piping facility.

B. Remove impurities from working tools and others in the dearating chamber.

C. Check completenesses of valves attached to the deaerator, valves in piping and automatic control valves etc.

D. Turn on pressure gauges and water level gauges installed at site.

E. Close all valves attached to the deaerator.

F. Open front and rear valves of air vent valve and feed water control valve for the deaerator to be operated.

G. Operate the deaerator feed water pump and slowly open the control valve by using the manual operating device of the feed water control valve. When the water is fed up to NWL-500mm, open the main valve to the generator of the water level indicating control alarm unit and switch the feed water control valve to "AUTO" mode. Check functions of the water level indicating control alarm unit and the overflow unit.
Further, check leakage of the water level gauge etc.

H. Open the main valve to boiler water feed pump and the minimum inflow valve for preparation of the boiler

water feed pump.

I. Open the drain inflow valve from the operating instruments.

4-2 Starting

A. Confirm that the preparation befor starting has been completed.

B. Confirm that the water level control valve works normally when the water level lowers due to the starting of boiler water feed pump.

C. Open valves at front and rear of the deaerator main valve and pressure control valve installed in the steam piping to prepare for passing steam.

*D. Discharge drain from the steam pipe.

*E. Gradually open the pressure control valve to pass steam by using the manual operating device of the pressure control valve. Temperature and pressure in the deaerating shell will rise slowly.

*F. When the pressure rises up to some extent (2.0 kg/cm^2G), open the main valve to the generator of the pressure indicating control alarm unit, set the detecting pressure, and switch the feed water control valve to "AUTO" mode.

G. Check normal functions of the water level indicating

control alarm unit, the pressure indicating control alarm unit and the instruments.

H. Since the orifice is equipped in the air vent pipe of this deaerator, pass air with the air vent valve, which has been opened when feeding water, opened as it is. Then, check air for being exhausted.

Note: In order to avoid water hammering phenomenon, pay special attention to the items attached with * marks.

4-3 Stopping

Stop the operation according to the following sequence.

A. Stop the boiler water feed pump.

B. Stop the deaerator water feed pump.

C. Close the pressure regulator valve.

D. Close the attached valves.

E. In case of long shut-down, completely discharge water from the deaerator and take countermeasures against generation of rust.

5. Control

5-1 Inspection and maintenance

Periodically check each part not only when trouble is found during inspection but when no abnormality is found.

Item	Content	Interval			
		Daily	Weekly	Monthly	Periodic
Water storage	Confirmation by water level gauge	○			
Inlet & outlet temp.	Confirmation by thermometers	○			
Pressure	Confirmation by pressure gauge	○			
Vent	Visual check of steam released from vent valve	○			
Dissolved oxygen quantity at inlet	Dissolved oxygen analysis according to JIS			○	
Dissolved oxygen quantity at outlet	- ditto -			○	
Water level & pressure regulators	Confirmation of working state	○			
Deaerator inside	Confirmation of ingress & generation of foreign matter and corroded condition				○
External view	Check of leakage from corner joint and breakage of insulator		○		

Caution: Pay special attention to the above items when the processing quantity is increased or decreased.

Notes 1) The charge of deoxidizer must be increased or decreased by adjusting O_2 quantity.

2) During shut-down of the deaerator, counter-measures to prevent air from leaking in the deaerator inside must be taken. As an example, the deaerator inside is to be kept at a steam pressurized condition. In this case, the condition must be checked about once a day.

(1) Water storage

It is very important to monitor the water storage in the water reservoir. Therefore, the water level must be checked on every specified interval and at the same time care must be taken to the fluctuation of water level, because an abnormally high water level will worsen the deaerating performance and an abnormally low level will cause burn-out of the feed water pump.

Further, an extreme fluctuation of the water level indirectly shows an abnormality of the control

unit or a fluctuation of the deaerator inside pressure and is a factor of worsening the deaerating performance, so that it is necessary not only to simply check the water level but to thoroughly monitor the state of water surface.

(2) Feed water inlet & outlet temperatures and inside pressure

Considering from the principle of the deaerator, an effective deaeration can not be expected if the temperature of deaeration water does not rise up to the saturation temperature corresponding to the inside pressure. For this reason, the temperatures and inside pressure must be checked on every specified interval.

(3) Air vent

Gas separated from the feed water is to be discharged into the deaerator, and this is the air vent process. The separated gas has a larger specific gravity than that of steam so that it becomes necessary to discharge the gas together with a slight quantity of steam.

This steam is called "carrier steam". Too small quantity of steam discharged from this air vent

will worsen the deaerating performance, while too large quantity thereof will induce an uneconomical waste of heat.

(4) Dissolved oxygen quantity

Since the dissolved oxygen quantity at outlet is the deaerating performance itself, it is necessary to check this value through chemical analysis at the time of trial running.

(5) Water level and pressure control units

Functioning conditions of the water level and pressure control units must be checked periodically. Considerable number of troubles in the deaerator will be caused by faulty condition of the control units.

(6) Thermal insulation

The thermal insulation of the deaerator is effective for preventing not only the heat loss due to radiation but the deterioration of performance caused by the phenomenon that the deaeration water at saturation temperature is cooled due to heat radiation to absorb free gas again. Therefore, the thermal insulation must be checked for completeness.

(7) Inspection of deaerator inside

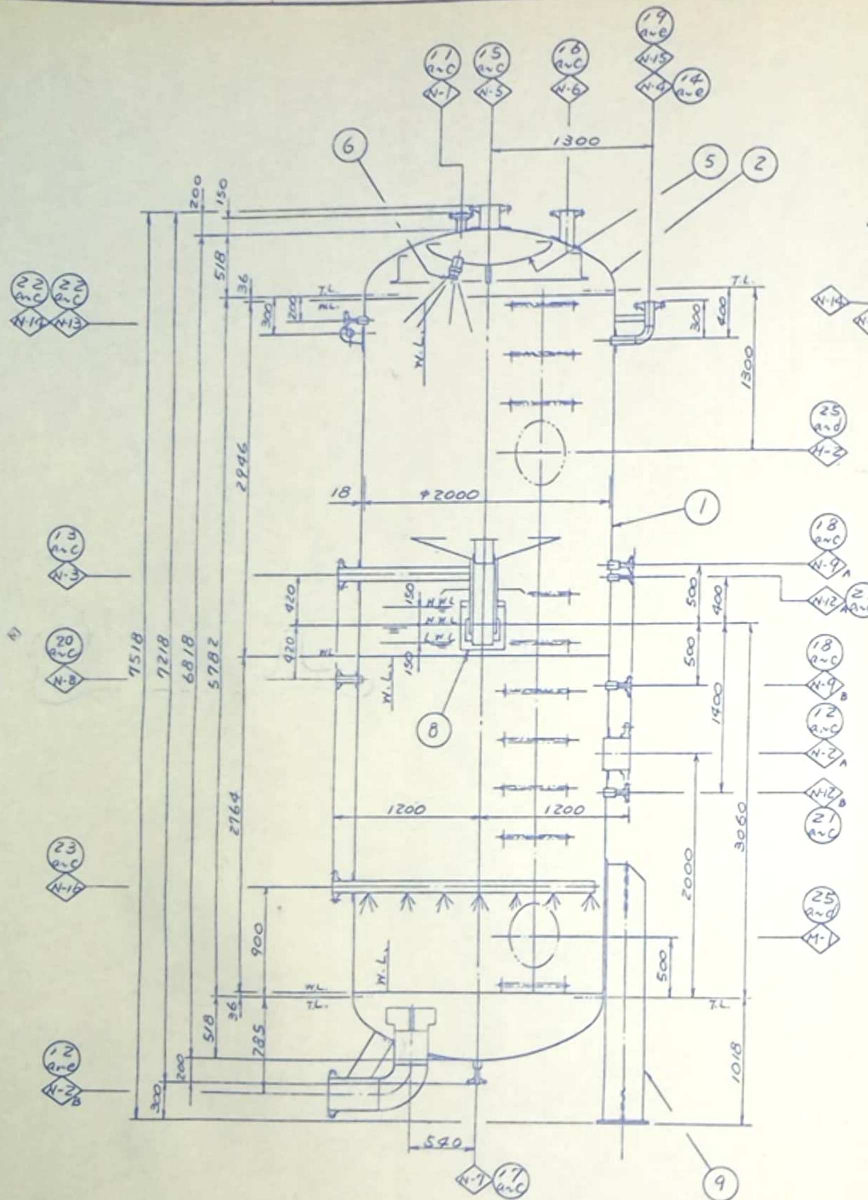
The inspection must be made in the deaerator to

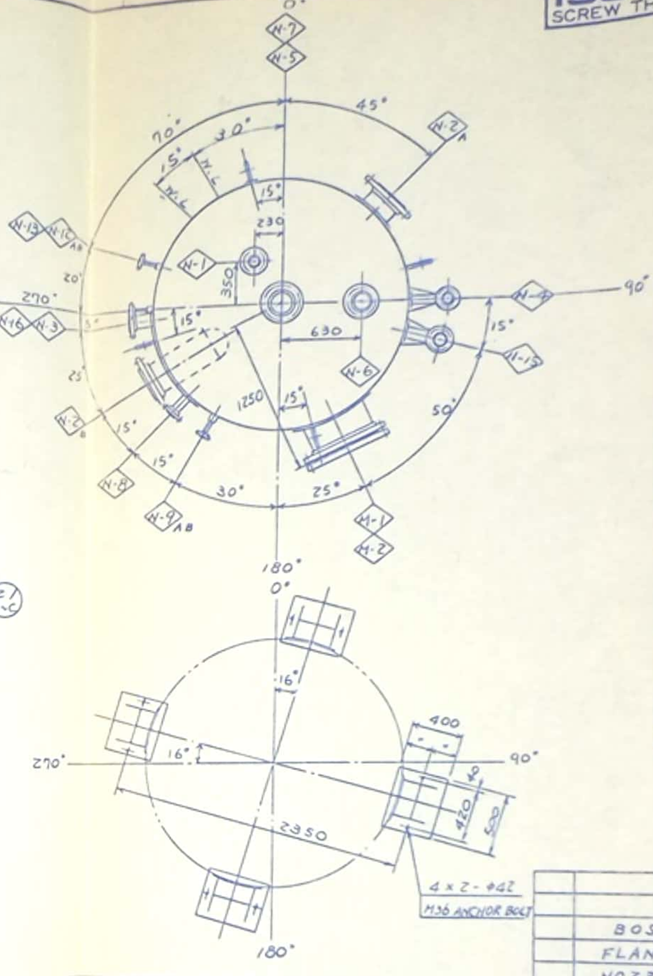
check its components for abnormality or the deaerator itself for generation of rust. In the event of abnormal state found, an appropriate countermeasure must be taken.

5-2 Periodic inspection

Item	Content	Remedy
Deaerator inside	1) Inside corrosion	1) Examine extent of corrosion at each point of shell and end plate. Measure plate thickness, if necessary.
	2) Ingress and generation of foreign matter	2) Thoroughly remove foreign matters. * This is to be done in case mainly of faulty deaerating performance.
Spray nozzle	1) Functioning state	1) Disassemble deaerator, and check following conditions by feeding water using deaerator water feed pump.
	2) Foreign matter caught in	a) Spraying condition b) Setting values of pressure and flow quantity 2) Take out spray nozzle from spray chamber seat (screw-in type) and remove foreign matter. Then, carry out item 1).

Item	Content	Remedy
Con'ed	Con'ed	* If function is still faulty even after carrying out item 1), replace spay nozzle with good one.
Safety valve	1) Blowing pressure	1) Let safety valve actuate and check its pressure. * If faulty, disassemble and adjust it or replace spring with new one.
	2) Leakege from valve seat	2) Disassemble safety valve and lap valve seat. * If faulty even after lapping, replace valve seat.
Water level gauge	Leakage from valve or glass	Retighten grand packing, or replace component.
Overflow valve	1) Opening/closing of valve	1) Check valve by moving it vertically with lever using hand.
	2) Leakage from each part	2) Retighten grand packing, or replace component.
Thermometer	Indicating value	* If faulty or broken, replace thermometer.
Pressure gauge	Indicating value	* If faulty or broken, replace pressure gauge.





ISO METRIC SCREW THREADS
THIRD ANGLE PROJECTION

REVISIONS	
1	SEP. 26th '91 FK
2	OCT. 24th '91 FK
3	OCT. 29th '91 FK
4	NOV. 1st '91 HH

DESIGN DATA

TYPE	—	SPRAY
DELIVERED CAPACITY	m³/h	AVE. MAKE-UP REC.R 19 (+13+6)
STORAGED CAPACITY	m³	10 (at N.W.L)
MAKE-UP & REC. R INLET TEMP	°C	90° / 120°
MAKE-UP WATER OUTLET TEMP	°C	40° / 120°
OPERATING STEAM PRESS	—	11 kg/cm²g × 187°C
HOT WATER & QUANTITY	m³/h	AVE. 45
O2 REMOVAL GUARANT	cc/l	0.04
OPERATING PRESSURE	kg/cm²G	11
OPERATING TEMP	°C	187
DESIGN PRESSURE	kg/cm²G	15
DESIGN TEMPERATURE	°C	210
POST WELD HEAT TREATMENT	—	NO
RADIOGRAPHED	—	SPOT
JOINT EFFICIENCY	—	0.95
CORR. ALLOWANCE	mm	1.0
CODE REQUIRED	—	JIS B 8243
HYDR. TEST PRESS.	kg/cm²G	22.5

CONNECTIONS

MARK	NO REQ'D	SIZE	RATING	SERVICE	REM'S
N-17	2	20"	ANSI150 LB 30 RF	MANHOLE	
N-16	1	3"		S. INLET FOR BOTTOM HEATING	
N-15	1	2½"		VACCUM PREVENTION	
N-14	1	½"		PT	
N-13	1	½"		PG	
N-12	2	¾"		LG	
N-9	2	1"		LT	
N-8	1	3"		LS	
N-7	1	1"		DRAIN	
N-6	1	4"		AIR VENT	
N-5	1	6"		REC. RETURN INLET	
N-4	1	2"		SAFETY VALVE	
N-3	1	4"		STEAM INLET	
N-2	2	10"		H. WATER OUTLET	
N-1	1	3"	ANSI150 LB 30 RF	MAKE-UP WATER INLET	

MARK	DESCRIPTION	MATERIAL	QUANTITY 1 SET	SPARE	TOTAL	REF. DWG. NO.	REMARKS
	BOSS	S25C-N	O				
	FLANGE	SF490A	O				
	NOZZLE	SB410	O				
9	SUPPORT	SS400/SS400	1 set				t6 etc
8	SCRUBBER	SS400/	1 set				
6	SPRAY NOZZLE	SCS13	3				φ50
5	WATER CHAMBER	SS400	1				φ1000×t6
2	SHELL COVER	SB450 O	2				t18 (2:1 ED)
1	SHELL	SB450 O	1				t18

QUANTITY PER 1 SET IS GIVEN IN THIS TABLE. MAKE FOR 1 SET

CUSTOMER: MITSUBISHI HEAVY INDUSTRIES, LTD. NAGASAKI SHIPYARD & MACHINERY WORKS.

KM-PROJECT

TITLE: DEAERATOR OUTLINE DRAWING

MANAGER	
CHIEF	
DUTY	T. Takeda
CHECKER	
CHARGED	F. Kamaoka
DATE	SEP. 26 '91
SCALE	1:30

MFG. SERIAL NO. 8269A DWG. NO. D91-50865 1/4

SEO KOATSU KOGYO CO., LTD. OSAKA JAPAN

DESIGN SECT REVIEW | DATE | SIGN | PLAN | DRAFT | CHECKED

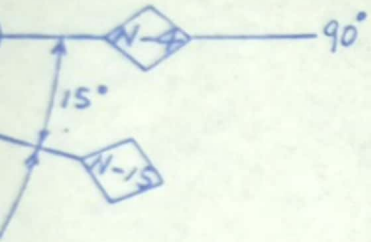
5 6

ISO METRIC SCREW THREADS | THIRD ANGLE PROJECTION

REVISIONS		
1	REV SEP. 26th '91 FK	
2	REV OCT. 24th '91 FK	
3	REV OCT. 29th '91 FK	YH.
4	REV NOV. 1 th '91 HH, FK	YH

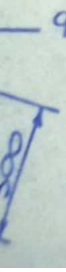
A

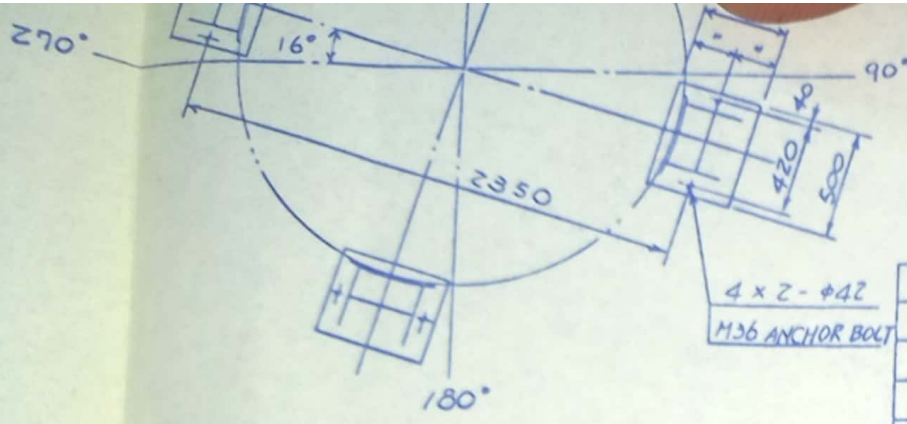
B



DESIGN DATA

TYPE	—	SPRAY
DELIVERD CAPACITY	M^3/H	AVE. MAKE-UP REC. R 19 (13+6)
STORAGED CAPACITY	M^3	10 (at N.W.L)
MAKE-UP/REC, R INLET TEMP.	°C	90° / 120°
MAKE-UP WATER OUTLET TEMP.	°C	90° / 120°
OPERATING STEAM PRESS.	—	11 Kg/cm²G × 187°C
HOT WATER IN QUANTITY	M^3/hr	AVE. 45
O_2 REMOVAL GUARANT	cc/ℓ	0.04
OPERATING PRESSURE	KG/CM^2G	11
OPERATING TEMP.	°C	187
DESIGN PRESSURE	KG/CM^2G	15
DESIGN TEMPERATURE	°C	210
POST-WELD HEAT TREATMENT	—	NO
RADIOGRAPHED	—	SPOT
JOINT EFFICIENCY	—	0.95
CORR, ALLOWANCE	MM	1.0
CODE REQUIRED	—	JIS B 8243
HYDR'C TEST PRESS.	KG/CM^2G	22.5





MARK	NO. REQ'D	SIZE	RATING	SERVICE	REM'S
M-1	2	20"	ANSI150 LJ SO RF	MANHOLE	
N-16	1	3"		S. INLET FOR BOTTOM HEATING	
N-15	1	2½"		VACCUM PREVENTION	
N-14	1	½"		PT	
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N-7	1	1"		DRAIN	
N-6	1	4"		AIR VENT	
N-5	1	6"		REC. RETURN INLET	
N-4	1	2"		SAFETY VALVE	
N-3	1	4"		STEAM INLET	
N-2	2	10"		M. WATER OUTLET / INLET	
N-1	1	3"	ANSI150 LJ SO RF	MAKE-UP WATER	

CONNECTIONS

MARK	DESCRIPTION	MATERIAL	TEST MARK	QUANTITY WORKING	QUANTITY SPARE	QUANTITY TOTAL	REF.DWG.NO.	REMARKS
	BOSS	S25C-N	O					
	FLANGE	SF490A	O					
	NOZZLE	SB410 STPT370/STPG370	O					
9	SUPPORT	SB450/SS400		1 SET				
8	SCRUBBER	SS400/SUS304		1 SET				t6 etc
6	SPRAY NOZZLE	SCS13		3				φ50
5	WATER CHAMBER	SS400		1				φ1000×t6 (10φ SD)
2	SHELL COVER	SB450	O	2				t18 (2:1 ED)
1	SHELL	SB450	O	1 SET				t18

QUANTITY PER 1 ~~UNIT~~ SET IS GIVEN IN THIS TABLE. MAKE FOR 1 ~~UNITS~~ SET.

MANAGER	/
CHIEF	T. Yoshiy
DUTY	T. Takeda
CHECKER	/
CHARGED	F. Kamemoto
DATE	SEP. 26. '91
SCALE	1:30
ORIGINAL DWG. NO.	

CUSTOMER: MITSUBISHI HEAVY INDUSTRIES, LTD. NAGASAKI SHIPYARD & MACHINERY WORKS.

KM-PROJECT

TITLE: DEAERATOR OUTLINE DRAWING

MFG. SERIAL NO. 8269A

DWG. NO. D91-50865 1/4

SEO KOATSU KOGYO CO., LTD. OSAKA JAPAN