



CLASS No.	2415M
SUB. No.	0054 G (1/5)

MODEL	8L28HX / ZP-41CP	WORK No.	K242735 / K242736 K242737 / K242738
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FOR FINAL

## **DRAWING & DOCUMENTS**

OWNER	JAYA SHIPBUILDING & ENGINEERING TED LTD.
SHIPYARD	PT. JAYA ASIATIC SHIPYARD
SHIP No. • SHIP NAME	888B 889B
SERIAL No.	ENG.: 24765 / 24766 24767 / 24768 ZP: P1343 / P1344 P1345 / P1346
CLASSIFICATION	AMERICAN BUREAU OF SHIPPING

### 1) ISSUE OF DRAWINGS

FOR APPROVAL : 5 SETS (INCLUDING 1 SET FOR RETURN)

FOR WORK : 3 SETS / 1 SHIP SET

⇒ FOR FINAL : 3 SETS / 1 SHIP SET +2CD

**Niigata Power Systems Co., Ltd.**

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PASSED	<b>S. Ehata</b>
CHECKED	<b>Y. Oshio</b>
DRAWN	<b>T. Kudou</b>
DATE	31-Aug-07

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TYPE 8L28HX / ZP-41CP		TITLE  CONTENTS	CLASS No.  SUB. No.				2415M  0054G (3/5)	
No.	DRAWING No.	DRAWING TITLE	LOCATION	FOR APPROVAL	FOR WORK	FOR FINAL	REMARKS	Q'TY/SHIP
【 MAIN ENGINE 】								
1	Z06101-30E	SPECIFICATION OF NIIGATA MARINE DIESEL ENGINE	—	○	○	○		—
2	75M 00084 B	GENERAL VIEW	E/R	○	○	○	8L28HX	2
3	F80 04091A 1/3	GEISLENGER COUPLING	M/E	○	○	○	BE72/15/140U-12	2
4	75M09829A	ENGINE FRONT P.T.O. DEVICE	E/R	○	○	○		2
5	24960-004A	SYMBOL MARKS FOR PIPING DIAGRAM	—	○	○	○		—
6	85M 02015A	PIPING DIAGRAM	—	○	○	○		—
【 FUEL OIL SYSTEM 】								
11	879 06113B	FUEL OIL FILTER ( PRIMARY FILTER )	E/R	○	○	○	RACOR	2
12	C79 01791A	FUEL OIL FILTER ( SECONDLY FILTER )	M/E	○	○	○	NU-08 325 MESH	2
13	C787 08017A	FUEL LEAKAGE OIL TANK	E/R	○	○	○		2
【 STARTING AIR SYSTEM 】								
21	886 05018A	STARTING AIR RESERVOIR	E/R	○	○	○	500 L X 2	1
22	C98 22133A	NON-RETURN VALVE ( FOR STARTING AIR )	E/R	○	○	○	40A	2
【 EXHAUST SYSTEM 】								
31	C91 24029B	EXHAUST EXPANSION JOINT	E/R	○	○	○	450A 550A	2 4
32	891 15629A	EXHAUST GAS SILENCER WITH SPARK ARRESTER	E/R	○	○	○	600A	2
33	20540-031A	INSTALLATION MANUAL FOR EXHAUST EXPANSION JOINT	—	○	○	○		—
【 LUB. OIL SYSTEM 】								
41	C888 04930A	LUB. OIL COOLER	E/R	○	○	○	35m <sup>2</sup>	2
42	879 15167A	LUB. OIL FILTER	E/R	○	○	○	30 μ m 100A	2
43	C30 43013A	LUB. OIL PRESS. REGULATING VALVE	E/R	○	○	○	65A	2
44	989 00735A	STAND-BY LUB. OIL PUMP	E/R	○	○	○	42m <sup>3</sup> /h×0.68MPa	2

TYPE		TITLE	CLASS No.				2415M	
8L28HX / ZP-41CP		CONTENTS	SUB. No.				0054G (4/5)	
No.	DRAWING No.	DRAWING TITLE	LOCATION	FOR APPROVAL	FOR WORK	FOR FINAL	REMARKS	Q'TY/SHIP
45	C989 17649A	GAUGE BOARD FOR STAND-BY LUB. OIL PUMP	E/R	○	○	○		2
46	985 51126A	STARTER PANEL FOR STAND-BY LUB. OIL PUMP	E/R	○	○	○		2
47	20540-00499	RECOMMENDED BRAND TABLE FOR MAIN ENGINE LUB. OIL	—	○	○	○		—
【 COOLING FRESH WATER SYSTEM 】								
51	C888 13842A	FRESH WATER COOLER	E/R	○	○	○	8m <sup>2</sup>	2
52	C98 22304A	BUTTERFLY VALVE FOR F.W. COMMON OUTLET	E/R	○	○	○	80A	2
53	C40 59001A	THROTTLE ASSEMBLY ( FOR AIR VENT. F.W. PIPING )	E/R	○	○	○	20A, ϕ 8	4
54	888 70051A	MAIN ENGINE JACKET HEATER	E/R	○	○	○	12kW	1
55	888 70052A	MAIN ENGINE JACKET HEATER	E/R	○	○	○	12kW	1
56	20540-054E	INSTRUCTION FOR USE OF COOLING WATER TREATING	—	○	○	○		—
57	20540-293	INSTRUCTION FOR AIR VENT PIPING IN FRESH WATER	—	○	○	○		—
【 SHAFTING 】								
81	75M 01204B	SHAFTING EQUIPMENT	—	○	○	○		2
82	C95 60079C	INTER MEDIATE SHAFT BEARING ( THRUST )	I/S	○	○	○	ϕ 140	4
83	C95 60079C	INTER MEDIATE SHAFT BEARING ( RADIAL )	I/S	○	○	○	ϕ 140	14
84	C95 60079C	UNIVERSAL JOINT FOR INTERM. SHAFT	I/S	○	○	○	ϕ 140	8
85	20540-00697	INSTRUCTION FOR ADJUST OF LENGTH FOR UNIVERSAL JOINT	—	○	○	○		—
86	C795 40022C	STUFFING BOX	I/S	○	○	○	ϕ 140	2
【 Z-PELLER 】								
91	89W 00115A	GENERAL VIEW OF Z-PELLER	Z/R	○	○	○	ZP-41CP	2
92	89W 15006A 89W 15016A	SLIPPING CLUTCH	Z/R	○	○	○	AGCP182	1 1
93	979 11958B	LUB. OIL FILTER	Z/R	○	○	○		2
94	20540-00548H	RECOMMENDED LUBRICANTS FOR Z-PELLER	—	○	○	○		—



TYPE		TITLE	CLASS No.				2415M	
8L28HX / ZP-41CP		CONTENTS	SUB. No.				0054F (5/5)	
No.	DRAWING No.	DRAWING TITLE	LOCATION	FOR APPROVAL	FOR WORK	FOR FINAL	REMARKS	Q'TY/SHIP
【 OTHER DOCUMENT 】								
101	2335M-0054	CALCULATION SHEETS OF TORSIONAL VIBRATION	—	○	○	○		—
102	2365M-10020	CALCULATION SHEETS OF PROPELLER	—	○	○	○		—
103	2415M-0054-1	TOOLS AND SPARE PARTS LIST	—	○	○	○	SEPARATE VOLUME	—
104	2415M-0054-2	REMOTE CONTROL DEVICE	—	○	○	○	SEPARATE VOLUME	—
105	20540-00766A	INSTALLATION MANUAL FOR NIIGATA Z-PELLER	—	○	○	○	ZP-41	—
106	20540-00735A	INSTALLATION MANUAL FOR INTERMEDIATE SHAFT BEARING	—	○	○	○	ZP-41	
107	20540-00677A	FITTING PROCEDURE OF CENTERING RING FOR INTERMEDIATE SHAFT BEARING	—	○	○	○	ZP-41	
108	20540-00782	GEISLENGER INSTALLATION MANUAL	—	○	○	○	BC63/15/140U	
109		TEST REPORT OF MAIN ENGINE & Z-PELLER	—	—	—	○		—
【 INSTRUCTION MANUAL 】								
111		INSTRUCTION MANUAL FOR ENGINE	—	—	—	○	6L28HX	—
112		INSTRUCTION MANUAL FOR GEISLINGER COUPLING	—	—	—	○	BE72/15/140U-12	—
113		INSTRUCTION MANUAL FOR TURBO CHARGER	—	—	—	○	TPS61D	—
114		INSTRUCTION MANUAL FOR GOVERNOR	—	—	—	○	UG8	—
115		INSTRUCTION MANUAL FOR CLUTCH	—	—	—	○	AGCP162AY	—
116		INSTRUCTION MANUAL FOR Z-PELLER	—	—	—	○	ZP-41	—
117		INSTRUCTION MANUAL FOR UNIVERSAL JOINT	—	—	—	○	GEWES	—
118		PARTS CATALOGUE FOR ENGINE	—	—	—	○	6L28HX	—
119		PARTS CATALOGUE FOR Z-PELLER	—	—	—	○	ZP-41	—

B  
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[NOTE]


SYMBOL OF LOCATION

M/E : MAIN ENGINE

E/R : ENGINE ROOM

Z/R : Z-PELLER ROOM

I/S : INTER MEDIATE SHAFT

	ZP-41 CP 750min <sup>-1</sup> , 4-dia2700 Skewed 8L28HX Wet sump, UJ RC (GSP-LEVER)	SPEC. No.	Z06101-30E
		CLASS No.	
		SUB. No.	

## TECHNICAL SPECIFICATIONS OF NIIGATA Z-PELLER PROPULSION SYSTEM

OWNER : JAYA SHIPBUILDING & ENGINEERING TED LTD.

SHIPYARD : PT. JAYA ASIATIC SHIPYARD

SHIP No. : 888B / 889B


KIND OF SHIP : 82m DP-2 ROV SUBSEA OPERATION VESSEL

CLASSIFICATION : American Bureau of Shipping (ABS)  
+A1(E)offshore support vessel +AMS,DP-2, Fire fighting class 1

MAIN ENGINE RATING : 2206 kW (3000 PS) / 750 min<sup>-1</sup> x 2 engines

### Contents

Section 1. General  
Section 2. Main engine specifications 8L28HX  
Section 3. Shafting  
Section 4. Z-pelle ZP-41CP  
Section 5. Remote control system

Mark	Revision	Drawn	Approved	Date
B	By the meeting on 17/May.	Y.Oshio	S.Ehata	2007/05/25
C	For approval	T.Kudo	S.Ehata	2007/08/31
E	Modify E part	Y.Oshio		2007/10/24

<p style="text-align: center;"><b>Marine Engineering Group</b>  <b>Engineering &amp; Technology Center</b>  <b>Niigata Power Systems Co., Ltd.</b></p> <p>TEL +81-25-274-5116      FAX +81-25-271-8474</p>	Approved	A.Etoh
	Passed	-----
	Drawn	A.Etoh
	Date	May. 08, 2007
	Total page	23 in total

## 1. GENERAL

### 1.1 GENERAL

This specification covers the supply of equipment and machinery for two (2) units of NIIGATA Z-peller propulsion apparatus for one (1) ship as follows.

- |                            |         |
|----------------------------|---------|
| 01) Main engine            | 2 units |
| 02) Clutch                 | 2 units |
| 03) Shafting line          | 2 units |
| 04) Z-drive propeller unit | 2 units |
| 05) Remote control system  | 1 set   |

### 1.2 STANDARDS AND RULES

All materials, design, manufacturing and tests of the equipment will conform to the following standards and rules unless otherwise specified.

- |         |                              |
|---------|------------------------------|
| 01) ABS | American Bureau of Shipping  |
| 02) JIS | Japanese Industrial Standard |
| 03) NES | Manufacturer's Standard      |

### 1.3 LANGUAGE AND UNITS

- 01) All drawings, documents and manuals for equipment shall be written in English.
- 02) Name plates and caution plates for equipment shall be written in English.
- 03) All weights, measures and dimensions shall be given in SI unit system. The scale of pressure gauges should be indicated by MPa.

### 1.4 PAINTING

#### 1.4.1 Painting scheme for inboard section

One (1) coat of rust preventive paint and one (1) coat of finish paint shall be applied to the equipment except the Z-peller immersed section prior to delivery.

**Standard color                      RAL 6019**

#### 1.4.2 Painting scheme for Z-peller immersed section

- 01) Shop primer:                      To be informed by Niigata later.
- 02) The anti-fouling paint shall be coated by shipyard.

### 1.5 SITE CONDITIONS

The operation of engines is attained under the following conditions ;

- |                               |                     |                        |
|-------------------------------|---------------------|------------------------|
| 01) Altitude                  | 101.3 kPa (760mmHg) | (Sea level)            |
| 02) Ambient temperature       | Max. 45 °C          | (in engine room)       |
| 03) Seawater temperature      | Max. 32°C           |                        |
| 04) Relative humidity         | Max. 90 %           | (in engine room)       |
| 05) Exhaust gas back pressure | 2.45 kPa (250 mmAq) | (at T/C outlet)        |
| 06) Temp. of low temp. F.W    | 38°C                | (at box cooler outlet) |

### 1.6 SHOP TEST

All tests and inspections during manufacture and assembling shall be carried out in accordance with Classification's rule, JIS, and manufacturer's standard practice unless otherwise specified.

The test program (procedure and schedule) shall be agreed with the Owner and Shipyard.

The test and inspection prior to delivery shall be final.

The test record and result of inspection shall be submitted.

1.6.1 The running test of diesel engine shall be carried out in the following conditions ;

- 01) Diesel engines to be loaded with hydraulic dynamometer.
- 02) Diesel engine to drive all mounted pumps except hydraulic pump for Z-peller.
- 03) Heat exchangers (L.O. and F.W. coolers) and starting air reservoir of ship's facilities to be used.
- 04) Marine diesel oil to be burnt.
- 05) Clean lube. Oil to be used.

1.6.2 Test procedure and schedule of main engines are as follows ;

- 01) Starting test
- 02) Load test
  - 25 % 20 minutes
  - 50 % 20 minutes
  - 75 % 20 minutes
  - 90 % 20 minutes
  - 100 % 60 minutes
  - 110 % 30 minutes
- 03) Governor test (Confirmation only)
- 04) Measuring temperatures of main bearings and others in crankcase.
- 05) Remote control test
- 06) Safety device test

1.6.3 Test procedure of Z-peller

The following tests shall be carried out at no load (in air).

- 01) Running test (Z-peller shall be driven by electric motor 120 minutes.)
- 02) Steering control function (Hydraulic pump shall be driven by electric motor.)
- 03) Measuring of temperatures and pressures
- 04) Teeth contact inspection of bevel gear at inspection holes.

## 1.7 SEA TRIAL AND BOLLARD PULL TEST

**B**

- 01) Sea trial should be carried out according to the regulation's requirements.
- 02) The conditions of the bollard pull test should be based on the Guidance Information issued by ABS and Niigata's Guide Lines for Bollard Pull Test.

## 1.8 EXCLUSION FROM THIS SPECIFICATIONS

- 01) Installation and operation works  
Labor, materials, tools and machinery for installation and operation onboard are not included in the manufacture's supply scope.
- 02) Outfitting works for piping and wiring  
The outfitting works and materials for piping and wiring are not included in the manufacture's supply scope.
- 03) Lubricating oil, hydraulic oil and fresh water additives.

## 1.9 SUPPLY OF DRAWINGS AND DOCUMENTS

The following drawings and documents shall be submitted to the shipyard directly.

- |   |                                     |
|---|-------------------------------------|
| 01) For approval  | 5 sets (including 1 set for return) |
| 02) For working   | 3 sets                              |
| 03) For final ("As built" drawings)   | 3 sets + 2 sets CD                  |
| 04) Calculation sheets of torsional vibration   | 3 sets + 2 sets CD                  |
| 05) Test records and results of inspection  | 3 sets + 2 sets CD                  |
| 06) Instruction manuals and parts catalogues  | 3sets + 2 sets CD                   |
| 07) Original Certificates of Classification   | Each 1 set + 2 sets CD              |
| 08) NOx emission enviroment certificate, issued by ABS<br>(EIAPP CERTIFICATE and TECHNICAL DATA SHET)<br>Mode : E2(constant speed mode) | 1 set + 2 sets CD                   |

**B**

## 2. MAIN ENGINE SPECIFICATIONS

### 2.1 PRINCIPAL PARTICULARS

01) Type	Vertical, single acting, 4-valves, 4-cycle, trunk piston type with turbo charger and charged air cooler.
02) Model	<b>NIIGATA 8L28HX</b>
03) Maximum continuous rating	2206 kW (3000 PS) at output shaft end of clutch (Hereinafter called as MCR)
04) Rated speed	750 min <sup>-1</sup>
05) Idling speed	400 min <sup>-1</sup>
06) Over load rating	110% MCR for 1 hour every 12 hours period.
07) Number of cylinder	8 (In-line)
08) Cylinder bore	280 mm
09) Piston stroke	370 mm
10) Max. combustion pressure	14.7 MPa or below
11) Brake mean effective pressure	1.936 MPa at MCR
12) Mean piston speed	9.25 m / s at MCR
13) Fuel supply system	Feed pump driven by engine
14) Fuel injection system	Solid direct injection
15) Lubricating system	Forced lubrication (Wet sump operation)
L.O.sump tank volume	Approx. 900 L / Unit Excluding oil in cooler, filter and piping
16) Starting system	Compressed air starting 3.0 MPa (30 kgf/cm <sup>2</sup> )
17) Cooling system	
Piston	With lube. oil (system oil)
Turbo charger	Non cooling type
Charged air cooler	With low temp.fresh water (L.T.F.W.)
Lube. oil cooler	With low temp.fresh water (L.T.F.W.)
Fresh water cooler	With low temp.fresh water (L.T.F.W.)
Fuel injection valve	Non cooling type
Cylinder jacket & head	With high temp.fresh water (H.T.F.W.)
18) Fuel oil	Marine diesel oil or Gas oil Corresponding to the following standards. ISO 8217, F-DMX and F-DMA ASTM D975, Grade No.1-D and Grade No.2-D
19) Lubricating oil	Corresponding to SAE # 40
20) Flywheel turning device	Ratchet gear with turning bar
21) Direction of rotation	(View from flywheel / output side of engine) Port engine Clockwise Starboard engine Clockwise
22) Dry mass	Approx. 21.5 tons / unit
23) Installation method	Rigid installation with "Chockfast" (supplied by shipyard)
24) Inclination of installation	Max. 5 degrees (Down to bow side)

## 2.2 SPECIFIC FUEL OIL CONSUMPTION

When fuel oil corresponding to 42.7 MJ/kg, net calorific value is used, the specific consumption is less than 198 g/kW-hr.

- 01) Subject to a tolerance of 3 % on the test operation.
- 02) Subject to be burned with marine diesel oil.
- 03) Engine load to be MCR and measured at crankshaft end (flywheel).
- 04) Subject to driving one (1) lube. oil pump, two (2) water pumps and (1) fuel feed pump.

## 2.3 SPECIFIC LUBRICATING OIL CONSUMPTION

The specific lubricating oil consumption is less than 1.09 g/kW-hr.

## 2.4 ACCESSORIES FOR ENGINE

### 2.4.1 Transmission system

FOR ONE SHIP

- |                             |   |          |
|-----------------------------|---|----------|
| 01) Flexible coupling       |   | 2 sets   |
| Type                        | Niigata Geislinger Coupling   |          |
| Lubrication                 | Forced lubrication with clutch L.O. pump  |          |
| Location                    | Directly coupled with flywheel  |          |
| 02) Propulsion clutch       | (See "Section-4" after this section.)   | 2 sets   |
| Type                        | Hydraulically actuated multiple-disc, wet type  |          |
| Location                    | Coupled with flywheel through flexible coupling   |          |
| 03) Engine front PTO flange | for Generator   | 2 sets   |
|                             | Flexible coupling, coupling bolts, nuts, gear box, clutch and fire - fighting pump are out of supply scope. |          |
|                             | Max.torque of PTO flange : 12.7 kN-m  | <b>B</b> |

### 2.4.2 Charged air system

- |                        |   |        |          |
|------------------------|---|--------|----------|
| 01) Turbo charger      |   | 2 sets | <b>B</b> |
| Type                   | Non-cooling, forced lubricating with system oil |        |          |
| Model                  | TPS   |        |          |
| Location               | Engine front side                               |        |          |
| 02) Charged air cooler |   | 2 sets |          |
| Type                   | Multi-tubular type (with fin)                   |        |          |
| Coolant                | Low temp. fresh water                           |        |          |
| Location               | Side wall of middle section of crankcase.       |        |          |

### 2.4.3 Fuel oil system

- |                          |  |       |
|--------------------------|--|-------|
| 01) Fuel oil filter      | (Primary filter)   | 2 pcs |
| Type                     | Triple one unit, "RACOR" filter with oil/water separate function |       |
| Location                 | Hull side (Loose supply)   |       |
| 02) Fuel oil inlet valve |  | 2 pcs |
| Location                 | Fore side of engine  |       |
| 03) Fuel oil feed pump   |  | 2 pcs |
| Type                     | Direct geared driven trochoid pump with safety valve             |       |
| Flow rate                | 1.0 m <sup>3</sup> /hr x 0.3 MPa (3.0 kgf/cm <sup>2</sup> )      |       |
| Location                 | Fore side of engine  |       |

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FOR ONE SHIP

04)	Fuel oil filter	(Secondly filter)	2 pcs	
	Type	Simplex type		
	Element	Notch wire, cleanable type while engine running		
		325 mesh		
	Location	Fore side of engine		
05)	Fuel injection pump	Bosch type	16 pcs	
06)	Fuel injection valve	Multi-hole, self injection, non-cooling	16 pcs	
07)	Fuel oil pressure regulating valve		2 pcs	
	Pipe size	32A		
08)	Fuel leakage oil tank		2 pcs	C
	Type	Steel plate fabrication		
	Pipe size	15A		
	Location	Hull side (Loose supply)		
09)	Fuel high press. union	Double skin cover type	16 pcs	
2.4.4 Starting air system				
01)	Starting air reservoir		1 set	
	Type	Vertical cylinder type		
	Capacity	500 liter x 2 (Twin bottle)		B
	Maximum pressure	3.0 MPa		
	Attachment	Check valve for charge air x 1		
		Charge air valves x 2      Starting air valves x 2		
		Safety valves x 2		
		Drain valves (Manual operation type) x 2		
		Valve for control air (10A) x 1		
		Valves for general use air (15A) x 1		
		Pressure gauges x 2      Inspection holes x 2		
		Valve for generator starting air x 1		B
	Location	Hull side (Loose supply)		
02)	Non-return valve		2 pcs	
	Pipe size	40A		
	Location	Hull side (Loose supply)		
03)	Stop valve	20A	2 pcs	
04)	Flame arrester for starting air main pipe		2 pcs	
05)	Distributor for starting air		2 pcs	
06)	Starting valve		16 pcs	
2.4.5 Exhaust system				
01)	Exhaust transition piece	450A	2 pcs	
02)	Exhaust expansion joint	450A (Loose supply)	2 pcs	E
	Exhaust expansion joint	550A (Loose supply)	4 pcs	E
03)	Silencer with spark arrester	600A, -35dB(A)	2 pcs	E
	Note) Noise reduction is depends on dimension of the silencer.			
	Location	Hull side (Loose supply)		
2.4.6 Lube. oil system				
01)	Lubricating oil pump		2 pcs	
	Type	Direct geared driven gear pump		
	Flow rate	60 m <sup>3</sup> /hr x 0.78 MPa (8 kgf/cm <sup>2</sup> )		
	Location	Fore side of engine		

-- Continued on the following page



FOR ONE SHIP

02)	Lube. oil pressure-regulating valve		2 pcs
	Pipe size	65A	
	Location	Hull side (Loose supply)	
03)	Lubricating oil cooler		2 pcs
	Type	Multi-tubular, shell type	
	Cooling surface area	The value shall be decided later	
	Coolant	Low temp. fresh water	
	Location	Hull side (Loose supply)	
04)	Lube. oil thermostatic control valve		2 pcs
	Type	Wax element	
	Setting temperature	51 – 60 °C	
	Pipe size	L.T.F.W. : 100A, LO : 100A	
	Location	On cooler	
05)	Line filter		2 pcs
	Type	Duplex, changeover type	
	Element	Notch wire, washable, 30 micron	
	Pipe size	100A	
	Location	Hull side (Loose supply)	
06)	Suction piping for main L.O. pump		2 pcs
	Pipe size	100A	
07)	Suction piping for stand-by lub. oil pump		2pcs
	Pipe size	100A	
08)	Lub. Oil centrifugal filter		2 pcs
	Type	Glacier type x twin (Tandem)	
	Location	Crank case door	
09)	Level gauge for oil sump		2 pcs
	Type	Sounding bar	
	Location	Crank case door	
10)	Stand-by & priming lube. oil pump		2 sets
	Type	Electric motor driven gear pump	
	Flow rate	42 m <sup>3</sup> /hr x 0.68 MPa	
	Electric motor	18.5 kW-AC440V-60Hz-3phase-Star Delta starting	B
		With space heater	
	Location	Hull side (Loose supply)	
	Starter panel	Wall mount type	
		Space heater control switch	

## 2.4.7 Cooling water system

01)	Low temp. fresh water pump		2 pcs
	Type	Direct geared driven centrifugal pump	
	Flow rate	110 m <sup>3</sup> /hr x 20 m	
	Pipe size	Suction : 100A, Delivery : 80A	
	Material of casing	Cast Iron	
	Material of impeller	Bronze casting	
	Material of shaft	Stainless steel	
	Type of shaft seal	Mechanical type	
	Location	Engine front	
	Distribution of water	For engine 90 m <sup>3</sup> /hr	
		For Propulsion units 20 m <sup>3</sup> /hr	

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FOR ONE SHIP

## 2.4.7 Cooling water system

- |     |  |  |          |
|-----|--|--|----------|
| 02) | High temp. fresh water pump  |  | 2 pcs    |
|     | Type   | Direct geared driven centrifugal pump                      |          |
|     | Flow rate  | 80 m <sup>3</sup> /hr x 30 m                               |          |
|     | Pipe size  | Suction : 100A, Delivery : 80A                             |          |
|     | Material of casing   | Cast Iron  |          |
|     | Material of impeller   | Bronze casting   |          |
|     | Material of shaft  | Stainless steel  |          |
|     | Type of shaft seal   | Mechanical type  |          |
|     | Location   | Engine front   |          |
| 03) | By-pass valve for charged air cooler   |  | 2 pcs    |
|     | Type   | 3-way valve, manual control                                |          |
| 04) | High temp. fresh water cooler  |  | 2 pcs    |
|     | Type   | Multi-tubular, shell type                                  |          |
|     | Cooling surface area   | The value shall be decided later)                          |          |
|     | Coolant  | Low temp. fresh water                                      |          |
|     | Location   | Hull side (Loose supply)                                   |          |
| 05) | High temp. fresh water thermostatic control valve                                |  | 2 pcs    |
|     | Type   | Wax element  |          |
|     | Setting temperature  | 68 - 78 °C   |          |
|     | Pipe size  | 100A   |          |
|     | Location   | On cooler  |          |
| 06) | Throttle plate for air escaping with flange(For Low and High fresh water piping) |  | 4 pcs    |
|     | Pipe size  | 20A  |          |
|     | Location   | Hull side (on air vent. Piping, Loose supply)              |          |
| 07) | Butterfly valve for F.W. common outlet   |  | 2 pcs    |
|     | Pipe size  | 100A   |          |
|     | Location   | Hull side (on H.T.F.W. engine outlet piping, Loose supply) |          |
| 08) | Engine jacket heater unit  |  | 2 pcs    |
|     | Type   | Electric type  |          |
|     | Type   | Heater : 6 kW x2 (12kW) – AC440V – 60Hz – 3 phase          | <b>B</b> |
|     |  | Circulating pump : 2.4 m <sup>3</sup> /hr x 16 m           |          |
|     | Attachment   | Heater unit, Pump unit, Control box                        |          |
|     |  | Overheat protection switch                                 |          |
|     | Location   | Hull side (Loose supply)                                   |          |

## 2.4.8 Instrument, control equipment and safety device

- |     |                |  |                     |
|-----|----------------|--|---------------------|
| 01) | Governor       |  | 2 pcs               |
|     | Type           | Mechanical Hydraulic type (UG-8) / motor control |                     |
|     | Model          | WoodWard   |                     |
| 02) | Fuel handle    | Lever type (Run - Start - Stop)                  | 2 pcs               |
| 03) | Gauge board    |  | 2 sets              |
|     | Tachometer     | Electric type (0 – 1000 min <sup>-1</sup> )      | <b>B</b>            |
|     | Pressure gauge | L.T.F.W inlet                                    | H.T.F.W inlet       |
|     |                | M/E lube. oil inlet                              | T/C lube. oil inlet |
|     |                | Boost air A/C outlet                             | Fuel oil inlet      |
|     |                | (Not apply)                                      |                     |
|     | Location       | Engine front                                     |                     |

## 2.4.8 Instrument, control equipment and safety device

FOR ONE SHIP

04)	100 °C thermometer	(Alcohol, bar type with cover)		
		H.T.F.W inlet (on engine)	2 pcs	
		H.T.F.W common outlet (on engine)	2 pcs	
		Boost air A/C outlet (on engine)	2 pcs	
		Lube oil inlet (on engine)	2 pcs	
		Lube. oil cooler inlet	2 pcs	
05)	500 °C thermometer	L.T.F.W at Lube.oil cooler inlet	2 pcs	<b>B</b>
		(Mercury, bar type with cover)		
		Exh. gas each cyl. Outlet	16 pcs	
06)	Crank case explosion relief valve	Exh. gas T/C outlet	2 pcs	
			8 pcs	
			16 pcs	
07)	Safety valve and indicator cock on cylinder head		16 pcs	
08)	Fuel rack stopper to prevent the engine overload		2 pcs	

## 2.4.9 Other accessories

01)	Engine driven H.T.F.W. pump assembly	1 pc
02)	Engine driven L.T.F.W. pump assembly	1 pc
03)	Engine driven F.O. feed pump assembly	2 pcs
04)	Maximum pressure indicator	1 pc
05)	Digital hand tachometer	1 pc
06)	Fuel valve test pump with pressure gauge	1 set
07)	Holding down bolts (Reamer & Non-fit bolts)	2 sets
08)	Special tools for overhaul & maintenance as per manufacturer's Standard	1 set
09)	Spare parts for Classification's requirement (ABS Unrestricted service)	1 set
10)	Spare parts and tools for turbo charger	1 set
11)	Not apply	
12)	Counter flange with bolts, nuts, and gasket	1 set

## 2.5 NOTE

The following items are out of Niigata's supply scope.

01)	Fuel oil daily tank	Level of tank bottom : Min. 1.5 m above crank shaft A
02)	Fresh water expansion tanks	Required capacity : 0.14 liter/kW (MCR) Approx. 260 liter/ engine
03)	Engine room ventilations	Not less than 0.27 Nm <sup>3</sup> /min-kW (MCR) for main engine Approx. minimum flow 1000 Nm <sup>3</sup> /min for two engines
04)	Main and emergency air compressors	
05)	Stand-by motor driven L.T.F.W. pump	Required capacity : 110 m <sup>3</sup> /hr x 20 m x 1 set
06)	Stand-by motor driven H.T.F.W. pump	Required capacity : 80 m <sup>3</sup> /hr x 30 m x 1 set
07)	Sea suction valves	
08)	Sea water strainers	
09)	Exhaust gas expansion joint on shipyard piping	
10)	Box cooler	
11)	Chock fast resin	

## 2.5 NOTE

### 12) Speed Governing during Constant Speed Mode

**Transient Speed Variations are to be within  $\pm 10\%$  of the rated Main Engine Speed**

Full Load of Shaft Generator Capacity thrown off. Engine Step Down Loading 600kW  $\rightarrow$  0 kW.

Excess of 10% may be acceptable provided separate overspeed device is being set by more than 15% for tripping.

0% to 50% of Generator Capacity thrown on. Engine Step Up Loading 0kW  $\rightarrow$  300kW.

The recovery times for both cases above described to be within  $\pm 1\%$  of final steady state condition shall not be more than 5 sec.

In case Power Management System approved by class is fitted, the application of loads in multiple steps of less than 50% of rated shaft generator capacity may be permitted provided that it is in accordance with the ABS rule Part 4-Chapter 6-Section 4 Figure 1.

**Permanent Speed variation is to be within  $\pm 2.5\%$  of the rated Main Engine Speed at any Load between no load and the full load.**

Parallel operation shall not be considered.

### 3. SHAFTING

#### 3.1 OUTLINE OF SHAFTING LINE

One (1) shaft lines consists of one (1) forward Cardan shaft, two (2) intermediate shafts and one (1) aft Cardan shaft between clutch and Z-peller unit.

#### 3.2 SUPPLY SCOPE

FOR ONE SHIP

01)	Cardan shaft (Universal Joint)		4 pcs	
	Type	Double cross joint with spline shaft		
	Max. tilting angle	6.5 degrees		
	Lubrication	Grease		
02)	Intermediate shaft		8 pcs	C
	Type of coupling	Built-up coupling with spigot (Keyless type)		
	Material of shaft	Forged steel		
	Minimum diameter	139 mm		
	Standard length	Approx. 2500 mm/pc		
03)	Intermediate shaft bearing		18 pcs	C
	Type of bearing	Cylindrical roller bearing		
	Bearing housing	Split type		
	Consist of	Self alignment type 4		C
		Radial bearing type 14		C
	Lubrication	Grease		
04)	Foundation bolts, nuts for intermediate shaft bearings		2 sets	
05)	Coupling bolts (Reamer bolts) and nuts for intermediate shafts		2 sets	
06)	Stuffing boxes for shaft sealing on engine room watertight bulkhead		2 sets	
07)	Centering tool set for universal joint angle		2 sets	

Note : Item 02) 03), length and quantity to be referd with final hull shaft arrangement

## 4.1 PRINCIPAL PARTICULARS

01)	Type	360 degrees steerable, Z drive propeller equipment
02)	Model	<b>NIIGATA ZP- 41CP</b>
03)	Construction	2-pairs of spiral bevel gears for 2-step reduction, controllable pitch propeller (CPP) ,Kort nozzle and small size bolt-up type mounting module with flat & parallel bottom plate Built-in electric clutch and power take off (PTO) device for driving steering hydraulic pump. Under water section of Z-peller can be lifted down from hull for maintenance and repair works during dry-docking.
04)	Clutch	Hydraulically actuated multiple-disc wet type
	Type	ON-OFF Clutch by electri control
	Model	AGCP182
05)	Input shaft speed	750 min <sup>-1</sup>
06)	Propeller shaft speed	242 min <sup>-1</sup>
07)	Reduction gear ratio	3.099
08)	Propeller	
	Type	Monoblock, 4-bladed, controllable pitch, skewed Kaplan type
	Diameter	2700 mm
	Material	Nickel-Aluminum Bronze (JIS-CAC703)
	Direction of rotation	Inboard at top (view from stern side.)
		Port unit Clockwise
		Starboard unit Counter Clockwise
10)	Kort nozzle	
	Type	19A, welded steel construction
	Material	Mild steel
		Stainless steel(JIS code SUS 316) for all inside of Kort nozzle
11)	Propeller shaft seal	
	Type	Lip seal
	Material of seal liner	Stainless steel
	No. of seal ring	Oil side : 1 pc
		Sea water side : 2 pcs
12)	Lubricating system	
	Upper gear case and clutch	Forced lubrication with self driving gear pump
	Lower gear case	Oil bath
	Oil specification	Against wear hydraulic oil ISO VG 100
	Oil volume	Approx. 2500 liter/unit
13)	Stem length	3410 mm (Distance between input and propeller shaft)
14)	Dry mass	Approx. 35.5 tons/unit

B

## 4.2 ACCESSORIES FOR Z-PELLER

FOR ONE SHIP

01)	Lubricating oil pump	For clutch oil and Z-peller lube. oil	: 2 pcs	
	Type	Direct geared driven tandem type gear pump		
	Flow rate of clutch oil	9.42 m <sup>3</sup> /hr x 2.3 MPa		
	Flow rate of lub. oil	12.6 m <sup>3</sup> /hr x 0.4 MPa		
02)	Oil filter			
	01) For oil pump suction	Gauze wire, simplex type, 100 mesh	: 2 pcs	
	02) For clutch control oil	Paper cartridge, simplex type, 10 micron	: 2 pcs	
03)	Lubricating oil filter		: 2 pcs	
	Type	Duplex, changeover type		
	Element	Gauze wire, washable, 150 mesh		
	Location	on Z-peller unit		
04)	Instrument			
	01) Pressure gauge for lub. oil		: 2 pcs	
	02) Pressure gauge for clutch oil		: 2 pcs	
	03) Thermometer for lub. oil	L.O. cooler inlet/outlet	: 4 pcs	
05)	Lubricating oil cooler		: 2 pcs	
	Type	Multi-tubular, shell type		
	Cooling surface area	10 m <sup>2</sup>		
	Coolant	L.T.fresh water		
	Location	on Z-peller unit		
06)	Pumping out device for drawing up the lube. Oil from bottom part		: 2 pcs	
07)	Lubricating oil filter for water discharge		: 2 pcs	
	Power source	AC440 V x 60 Hz x 3 phase		<b>B</b>
	Attchment	Electric motor/Filter		
	Location	Hull side		
	Starter panel is out of Niigata's supply scope.			
08)	Bottom drain valve	Self closing type	: 2 pcs	
09)	Lub. oil level gauge	Sounding bar type	: 2 pcs	
10)	Protection zinc	Bolt-up type	: 24 pcs	
	Protection zinc shall be provided for necessary quantity for five years operation as spare.			<b>A</b>
11)	Rope guard for propeller shaft seals		: 2 sets	
12)	Foundation bolts( Reamer bolts & non-fit bolts), nuts and O-ring for installation		: 2 sets	
13)	Spare hydraulic oil pump completed set for emergency use (For clutch & lube. oil)		: 1 pc	
14)	Spare parts and tools as Manufacturer's Standard		: 1 set	
15)	Hydraulic screw jack for fitting propeller		: 1 set	
16)	Upper and lower unit assembly kit (O ring and stainless wire for bolts locking)		: 2 sets	<b>A</b>

## 4.3 OUTLINE OF HYDRAULIC SYSTEM FOR STEERING CONTROL

01)	Operation system	Main engine driven hydraulic system		
02)	Steering angle	360 degrees		
03)	Steering speed			
	By main hydraulic pump	Approx. 12 sec/ 180 degrees at 12 knots		
		Z-peller can be turned in constant speed regardless of fluctuation of engine speed.		
04)	Required power source			
	For main hydraulic pump	Not required. (PTO pump driven by main engine.)		
	For portable hydraulic pump	0.4 kW-AC440V-60Hz-3 phase-1 sets/ ship		<b>B</b>
05)	Hydraulic fluid			
	Oil specification	Anti-wearing hydraulic oil ISO VG 46 or VG68		
	Oil volume	Approx. 250 liter/unit		

#### 4.4 ACCESSORIES FOR STEERING HYDAULIC SYSTEM FOR ONE SHIP

01)	Main hydraulic pump unit for steering control		: 2 pcs
	Type	Main engine driven variable displacement pump.	
	Location	Hull side (Loose supply)	
02)	Hydraulic tank unit	Tank capacity : Approx. 100 litter	: 2 pcs
	Location	Hull side (Loose supply)	
03)	Suction filter		: 2 pcs
	Type	Simplex, 10 micron paper cartridge with safety valve	
	Location	Limit switch for filter clogged alarm on Z-peller unit	
04)	Hydraulic oil cooler	on hydraulic tank unit	: 2 pcs
	Type	Multi-tubuler, shell type	
	Cooling surface area	3 m <sup>2</sup>	
	Coolant	L.T. fresh water	
	Location	on hydraulic tank unit	
05)	Hydraulic motor	on Z-peller unit	: 4 pcs
06)	Portable hydraulic oil pump		1 set
	Use	To change the nozzle position for control system adjustment without engine operation.	
	Type	Electric motor driven trochoid pump	
	Motor capacity	0.4 kW x AC440 V x 60 Hz x 3 phase	
	Location	Loose supply	
07)	Spare parts for hydraulic system		: 1 set

#### 4.5 OUTLINE OF HYDRAULIC SYSTEM FOR PROPELLER PITCH CONTROL

01)	Operation system	Electric motor driven hydraulic system	
02)	Pitch control angle	Astern 20 degrees to ahead 30 degrees	
03)	Pitch control speed	Approx. 15 sec/30 degrees(in constant speed)	
04)	CPP hydraulic pump unit		
	Type	Electric motor driven gear pump	
	Flow rate of lube. oil	Main pump 3.6 m <sup>3</sup> /hr Secondary pump 1.26 m <sup>3</sup> /hr	
	Attachment	Filter, control valve, pressure switch	
	Location	Hull side (Loose supply)	
	Hydraulic fluid	Z-peller lub. Oil to be used.	
05)	Required power source		
	For main hydraulic pump	15kW-AC440V-60Hz-3 phase-Star/Delta starting 2 sets/ship	C
	For secondary pump	5.5kW-AC440V-60Hz-3 phase Direct starting 2 sets/ship	C
	Starter box	Hull side (Loose supply)	
	Note: When main pump pressure is in failed, secondary pump can start automatically.		

#### 4.6 NOTE

- 01) The cooling water for lub. oil cooler to be supplied by M/E sea water pump.
- 02) When delivery from Ohta Plant, the Z-peller unit shall be disassembled into three parts.
- 03) All of paper cartridge type filter to be replaced to new one, after sea trial.



## 5. REMOTE CONTROL SYSTEM

### 5.1 ELECTRIC POWER & COMPRESSED AIR SOURCE

#### 5.1.1 Required electric power source

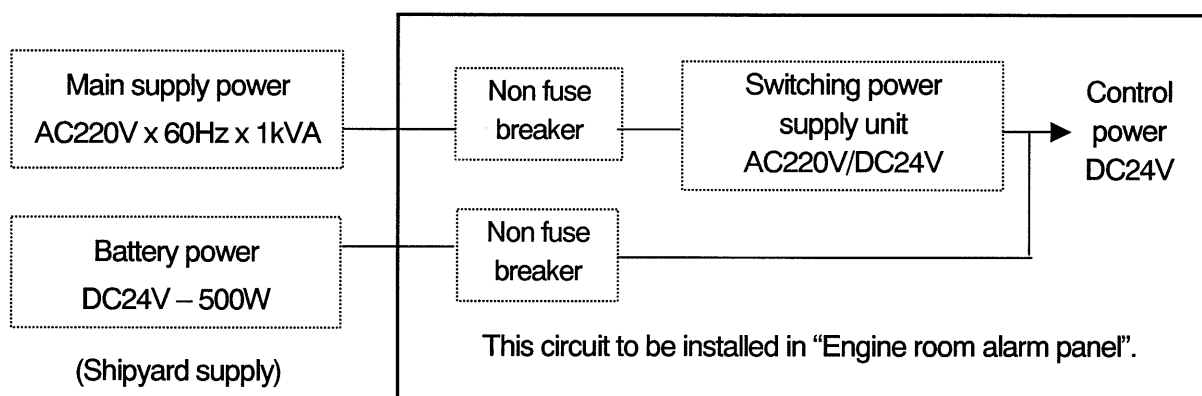
The following power source to be supplied from generator system onboard.

- |                       |   |          |
|-----------------------|---|----------|
| (1) For main supply   | AC220V x 60Hz x 1 phase x Approx. 1.0 KVA x 2 | <b>B</b> |
| Voltage fluctuation   | + 6% ~ - 10%                                  |          |
| Frequency fluctuation | + 5% ~ - 5%                                   |          |
| (2) For back-up       | DC24V (Battery power) x Approx. 500 W x 2     |          |
|                       | Voltage fluctuation to be within $\pm 10\%$ . |          |

#### 5.1.2 Block diagram for remote control power source

The following diagram is shown for one unit. Two (2) units are required.

If main supply power (AC) is failure or the switching power supply unit is in any trouble, the control power is changed over to the battery power automatically.



#### 5.1.3 Distribution of control circuits

The control power is distributed as follows and the separate circuit protectors (CP) are provided for every control functions groups.

- |  |                  |
|--|------------------|
| 01) Main Steering control circuit        | Port & starboard |
| 02) Secondary steering control circuit   | Port & starboard |
| 03) Main engine control circuit          | Port & starboard |
| 04) Main engine shutdown control circuit | Port & starboard |
| 05) General (Miscellaneous) use          | common           |
| 06) Thrust direction indicator           | Port & starboard |

#### 5.1.4 Compressed air (0.7 MPa)

- 01) To be supplied from M/E starting air reservoir through reducing valve unit.
- 02) To be used for automatic shutdown.

**E**

## 5.2 OUTLINE OF REMOTE CONTROL SYSTEM

## 6.2.1 Outline of remote control system

Description		Wheel house fore and aft control console	Engine control room alarm panel	Local	Control medium
Steering control		GSP-LEVER x 4 The combination control can be done for steering, engine speed clutch and propeller pitch.	-	Manual	Electric (DC24V) and hvdraulic
Ahead-astern control					
M/E speed control			-	Manual	Electric (DC24V)
Clutch on / off control		Push button switch	Push button switch	Manual	Electric (DC24V) and pneumatic
Propeller pitch control		GSP-LEVER Pitch dial Push button SW	-	Manual	
M/E emergency stop		Push button SW (with cover)	Push button SW (with cover)	Manual	
M/E automatic shutdown		Over speed M/E lube. oil pressure failure (excessive low)			
M/E and CPP control position change-over		Push button SW for Acknowledge	Changeover SW (W/H – E/R)	Bell with red lamp	Electric (DC24V)
ZP control position change-over for steering control		-	-	Change over SW (W/H – ZP)	Electric (DC24V)
Main engine telegraph system		Out of Niigata's supply scope			
Indicator	ZP thrust direction	Analog	Analog	Mechanical	
	Main engine speed	Analog	Analog	Analog	
	T/C speed	—	Digital	—	
	Propeller pitch angle	Analog	Analog	Mechanical	
	Propeller speed	Analog	Analog	—	

**Note** 01) Main engine to be started and stopped at engine side.

02) The following items to be out of Niigata's supply scope;

- (1) Wheel house control console(s)
- (2) Control console and alarm console in engine control room (ECR).
- (3) Auto-pilot, Joy-stick and Dynamic Position (DP-2) system
- (4) VDR(Voyage Data Recorder) system

## 5.2.2 Steering control system

Items	Main control	Secondary	Auto-pilot	Emergency
Control position	Wheel house	Wheel house	Wheel house	Z-peller room
Control power	DC24V	DC24V	Unknown	No required.
Operation device	GSP-lever	Push bitton SW	Auto-pilot	Manual lever
Hydraulic pump	Main pump	Main pump	Main pump	Main pump
Control principal	Follow-up	Non-follow	Follow-up	Non-follow

Note These systems are individual for Port and Starboard respectively.

## 5.2.3 Pitch control system

Items	Main control	Main control	Secondary	Emergency
Control position	Wheel house	Wheel house	Wheel house	Local
Control power	DC24V	DC24V	DC24V	No required.
Operation device	GSP-lever	Pitch control dial	Push button	Manual lever
Control principal	Follow-up	Follow-up	Non-follow	Non-follow
Control range	AS 20 deg. – AH 30 drg.			

Note These systems are individual for Port and Starboard respectively.

## 5.3 REMOTE CONTROL SYSTEM EQUIPMENTS

		FOR ONE SHIP	LOCATION
01)	Drop in type panels for wheel house control FWD console	1 set	W / H
(1)	GSP Lever	P/S each 1	
(2)	Indicator panel	P/S each 1	
(3)	M/E & Z-peller control panel	P/S each 1	
(4)	Control card for ME, CL, & ZP	P/S each 1	
	Note ; Z-peller control card has a function of atuo-pilot interface Details are described in the next paragraph		
02)	Drop in type panels for wheel house control AFT console	1 set	W / H
(1)	GSP Lever	P/S each 1	
(2)	Indicator panel	P/S each 1	
(3)	M/E & Z-peller control panel	P/S each 1	
	Note ; Details are described in the next paragraph		
03-1)	Engine control panel (Drop in type)	1 set	ECR <b>B</b>
(1)	Indicators	As per attached list	
(2)	Control switches	P/S each 1	
(3)	Indicating lamp panel	P/S each 1	
03-2)	Engine control panel (Standing type, cable inlet at bottom)	1 set	E / R
(1)	Control circuit	P/S each 1	
(2)	M/E shutdown circuit	P/S each 1	
(3)	M/E meter relay	P/S each 1	
(4)	Main power supply switch (NFB)	P/S each 1	
(5)	Back-up power switch (NFB)	P/S each 1	
(6)	Power supply unit(AC220/DC24V)	P/S each 1	<b>B</b>
03)	Drain separator for control air with air filter ( Wall mount type)	1 set	E/R
04)	Control air panel ( Wall mount type )	1 set	E/R
05)	Electric-pneumatic converter panel for GV (Wall mount type)	1 set	E/R
06)	Bell for control position change over (with red lamp)	1 set	E/R
07)	Bell for alarm (with red lamp)	1 set	E/R
08)	Follow-up transmitter for Z-peller direction (With thrust direction indicator – Mechanical type)	2 pcs	Z-peller
09)	Thrust direction indicator box (installed near clutch)	2 pcs	E/R
10)	Pneumatic actuator for M/E shutdown system	2 pcs	M/E
11)	Speed sensor		
(1)	For M/E speed indicator	magnetic pick-up	M/E
(2)	For Z-peller control	magnetic pick-up	M/E
(3)	For propeller speed indicator	magnetic pick-up	Clutch
(4)	For T/C speed indicator	magnetic pick-up	T/C
12)	Spare parts for remote control system	Electric parts	-
13)	Handy terminal for M/E & ZP control card	1 set	-

## 5.4 DETAILS OF INDICATOR, CONTROL SWITCH &amp; INDICATING LAMP

Remarks P/S means "Port unit and Starboard unit"

Description		W/H fore Console	W/H aft Console	Engine room Control console	Remarks
Indicators	01 Thrust direction	P/S each 1	P/S each 1	P/S each 1	
	02 Main engine speed	P/S each 1	P/S each 1	P/S each 1	
	03 Propeller speed	P/S each 1	P/S each 1	P/S each 1	
	04 Propeller pitch angle	P/S each 1	P/S each 1	P/S each 1	
	05 Main engine running hour meter	----	----	P/S each 1	
	06 T/C speed	----	----	P/S each 1	Digital type
	07 Main engine L.O. press.	P/S each 1	P/S each 1	P/S each 1	
	08 Main engine H.T.F.W.Temp.	P/S each 1	P/S each 1	P/S each 1	
	09 Control air press.	P/S each 1	----	----	
Introl handle, switches & buzzer	01 GSP-LEVER	P/S each 1	P/S each 1	----	
	02 Clutch engaged	P/S each 1	P/S each 1	----	Push button SW
	03 Clutch disengaged	P/S each 1	P/S each 1	----	Push button SW
	04 Propeller pitch control dial	P/S each 1	P/S each 1	----	
	05 Pitch control (Ahead)	P/S each 1	P/S each 1	----	Push button SW
	06 Pitch control (Astern)	P/S each 1	P/S each 1	----	Push button SW
	07 Main engine emergency stop	P/S each 1	P/S each 1	P/S each 1	Push button SW (with cover)
	08 Main engine control position (W/H - E/R)	----	----	P/S each 1	Change over SW
	09 Acknowledge of W/H control	P/S each 1	----	----	Push button SW
	10 Main engine control position (FORE – AFT)	P/S each 1	----	----	Change over SW
	11 Acknowledge of AFT control	----	P/S each 1	----	Push button SW
	12 Buzzer for changeover	P/S each 1	P/S each 1	----	
	13 Main supply power (AC220V)	----	----	P/S each 1	Non fuse breaker
	14 Back-up power (DC24V)	----	----	P/S each 1	Non fuse breaker
	15 Main engine control mode (Joy-stick /DP– Constant speed)	P/S each 1	----	----	Change over SW <b>B</b>
	16 Steering control mode (Joy-stick /DP– Main – Autopilot)	P/S each 1	----	----	Change over SW
	17 Steering control – mode (Secondary- Main)	P/S each 1	P/S each 1	----	Change over SW
	18 Secondary steering switch (Left turn– Right turn)	P/S each 1	P/S each 1	----	Push button SW
	19 CPP control mode (Main– Dial – Sec.)	P/S each 1	----	----	Change over SW
	20 Dimmer SW for meters	P/S each 1	P/S each 1	----	
	21 Dimmer SW for meters	P/S each 1	P/S each 1	----	

## 5.4 DETAILS OF INDICATOR, CONTROL SWITCH &amp; INDICATING LAMP

Remarks P/S means "Port unit and Starboard unit"

Description	W/H fore Console	W/H aft Console	Engine room Control console	Remarks
01 Wheel house control / Main engine and CPP	P/S each 1	P/S each 1	P/S each 1	White
02 Engine room control / Main engine and CPP	P/S each 1	P/S each 1	P/S each 1	White
03 Wheel house control / Steering	P/S each 1	P/S each 1	P/S each 1	White
04 Local control / Steering	P/S each 1	P/S each 1	P/S each 1	White
03 Wheel house fore control	P/S each 1	P/S each 1	----	White
04 Wheel house aft control	P/S each 1	P/S each 1	----	White
05 Clutch engage	P/S each 1	P/S each 1	P/S each 1	Green
06 Clutch disengage	P/S each 1	P/S each 1	P/S each 1	Red
07 Main engine control / Main	P/S each 1	P/S each 1	P/S each 1	White
08 Main engine control / Joy-stick /DP	P/S each 1	P/S each 1	P/S each 1	White
09 Steering control / Main	P/S each 1	P/S each 1	P/S each 1	White
10 Steering control / Joy-stick /DP	P/S each 1	P/S each 1	P/S each 1	White
11 Steering control / Secondary	P/S each 1	P/S each 1	P/S each 1	White
12 CPP control mode / Main	P/S each 1	P/S each 1	P/S each 1	White
13 CPP control mode / Joy-stick /DP	P/S each 1	P/S each 1	P/S each 1	White
14 CPP control mode / Dial	P/S each 1	P/S each 1	P/S each 1	White
15 CPP control mode / Push button	P/S each 1	P/S each 1	P/S each 1	White
16 Main control power	P/S each 1	P/S each 1	P/S each 1	White
17 M/E shut down power	P/S each 1	P/S each 1	P/S each 1	White
18 Main steering control power	P/S each 1	P/S each 1	P/S each 1	White
19 Secondary steering control power	P/S each 1	P/S each 1	P/S each 1	White
20 CPP Hyd. main pump running	P/S each 1	P/S each 1	P/S each 1	Green
21 CPP Hyd. Sec. pump running	P/S each 1	P/S each 1	P/S each 1	Red
22 Propeller pitch neutral position	P/S each 1	P/S each 1	P/S each 1	Green
23 Main supply power (AC220V)	P/S each 1	P/S each 1	P/S each 1	White
24 Back-up power (DC24V)	P/S each 1	P/S each 1	P/S each 1	White
25 Auto-pilot control	P/S each 1	P/S each 1	P/S each 1	White

## 5.4 DETAILS OF INDICATOR, CONTROL SWITCH &amp; INDICATING LAMP

Remarks P/S means "Port unit and Starboard unit"

Description		W/H fore Console	W/H aft Console	Engine room Control console	Remarks
Alarm Indicating lamps	01 M/E emergency stop	P/S each 1	P/S each 1	P/S each 1	Red
	02 Over speed trip	P/S each 1	P/S each 1	P/S each 1	Red
	03 M/E L.O press. low trip	P/S each 1	P/S each 1	P/S each 1	Red
	04 M/E fuel oil leakage	P/S each 1	P/S each 1	P/S each 1	Red
	05 M/E L.O press. Low	P/S each 1	P/S each 1	P/S each 1	Red
	06 M/E L.O sump level low	P/S each 1	P/S each 1	P/S each 1	Red
	07 M/E TC L.O press. low	P/S each 1	P/S each 1	P/S each 1	Red
	08 M/E H.T.F.W temp. high	P/S each 1	P/S each 1	P/S each 1	Red
	09 M/E L.T.F.W press. low	P/S each 1	P/S each 1	P/S each 1	Red
	10 M/E overload	P/S each 1	P/S each 1	P/S each 1	Red
	11 Z-peller / Clutch L.O press. low	P/S each 1	P/S each 1	P/S each 1	Red
	12 Z-peller / Clutch L.O temp.high	P/S each 1	P/S each 1	P/S each 1	Red
	13 Charge pump press. low	P/S each 1	P/S each 1	P/S each 1	Red
	14 Steering hydraulic oil tank level low	P/S each 1	P/S each 1	P/S each 1	Red
	15 Steering hydraulic oil temp high	P/S each 1	P/S each 1	P/S each 1	Red
	16 Steering Hyd. oil suction filter clogged	P/S each 1	P/S each 1	P/S each 1	Red
	17 C.P.P. hydraulic oil tank level Low	P/S each 1	P/S each 1	P/S each 1	Red
	18 C.P.P. hydraulic oil temp high	P/S each 1	P/S each 1	P/S each 1	Red
	19 C.P.P Hyd. oil suction filter clogged	P/S each 1	P/S each 1	P/S each 1	Red
	20 C.P.P. hydraulic oil press.low	P/S each 1	P/S each 1	P/S each 1	Red
	21 C.P.P. hydraulic oil press.high	P/S each 1	P/S each 1	P/S each 1	Red
	22 M/E starting air press.low	1	1	1	Red
	23 M/E control air press. low	1	1	1	Red
	24 Control air main valve closed	1	1	1	Red
	25 Power supply unit trouble	P/S each 1	P/S each 1	P/S each 1	Red
	26 Main supply power failure	P/S each 1	P/S each 1	P/S each 1	Red
	27 Back up power failre	P/S each 1	P/S each 1	P/S each 1	Red
	28 M/E shutdown power failre	P/S each 1	P/S each 1	P/S each 1	Red
	29 M/E control unit(card) failure	P/S each 1	P/S each 1	P/S each 1	Red
	30 Clutch control unit (card)failure	P/S each 1	P/S each 1	P/S each 1	Red
	31 Z-peller control unit(card) failure	P/S each 1	P/S each 1	P/S each 1	
	32 CPP control unit(card) failure	P/S each 1	P/S each 1	P/S each 1	Red

## 5.5 LISTS OF PRESSURE, THERMAL AND LIMIT SWITCH

	<u>Description</u>	<u>Use</u>	<u>Kind of switch</u>	<u>Q'ty</u>	<u>Location</u>	<u>Remarks</u>
01)	M/E L.O. press. too low	Shutdown	Press. SW	2	M/E	
02)	M/E F.O. leakage	Alarm	Level SW	2	Leakage tank	
03)	M/E L.O. press. low	Alarm	Press. SW	2	M/E	
04)	M/E oil sump level	Alarm	Level SW	2	M/E	
05)	M/E T.C.L.O. press. low	Alarm	Press. SW	2	M/E	
06)	M/E H.T.F.W temp. high	Alarm	Thermal SW	2	M/E	
07)	M/E L.T.F.W press. low	Alarm	Press. SW	2	M/E	
08)	M/E overload	Alarm	Limit SW	2	M/E	
09)	Reset of Shutdown	----	Limit SW	2	M/E	
10)	ZP/Clutch L.O. press. low	Alarm	Press. SW	2	Clutch	
11)	ZP/Clutch L.O. temp. high	Alarm	Thermal SW	2	Clutch	
12)	Clutch On / Off	Indication	Press. SW	2	Clutch	
13)	Charge pump press. low	Alarm	Press. SW	2	Hydr. pump	
14)	Hydraulic tank level low	Alarm	Level SW	2	Hydr. tank	
15)	Hydraulic oil temp. high	Alarm	Thermal SW	2	Hydr. tank	
16)	Hydro. Filter clogged	Alarm	limit SW	2	Hyd.filter	
17)	CPP Hyd tank level low	Alarm	Level SW	2	ZP	
18)	CPP Hydr. oil temp. high	Alarm	Thermal SW	2	CPP Con.unit	
19)	CPP Hyd. Filter clogged	Alarm	limit SW	2	Hyd.filter	
20)	CPP Hydr. oil press. low	Alarm	Press. SW	2	CPP Con.unit	
21)	CPP Hydr. oil press. high	Alarm	Press. SW	2	CPP Con.unit	
22)	Starting air press. low	Alarm	Press. SW	1	Air tank	
23)	Control air press. low	Alarm	Press. SW	1	Air panel	
24)	Control air main valve	Alarm	Limit SW	1	Air tank	
25)	M/E L.O. press.	Indicate	Press. Trans.	2	M/E	
26)	M/E H.T.F.W temp.	Indicate	Thermo couple	2	M/E	
27)	Control air press.	Indicate	Press. Trans.	1	Air panel	




## 5.6 LISTS OF SIGNAL FOR VDR

	<u>Description</u>	<u>Kind of signal</u>	<u>Q'ty</u>	<u>Remarks</u>
01)	M/E emergency stop	Dry contact	P/S each 1	
02)	M/E over speed trip	Dry contact	P/S each 1	
03)	M/E L.O press. low trip	Dry contact	P/S each 1	
04)	M/E starting air press.low	Dry contact	P/S each 1	
05)	M/E abnormal alarm	Dry contact	P/S each 1	
06)	ZP/CL abnormal alarm	Dry contact	P/S each 1	
07)	Steering abnormal alarm	Dry contact	P/S each 1	
08)	Steering Hyd.oil tank level low	Dry contact	P/S each 1	
09)	CPP abnormal alarm	Dry contact	P/S each 1	
10)	Power supply unit trouble	Dry contact	P/S each 1	
11)	Main supply power failure	Dry contact	P/S each 1	
12)	Back up power failure	Dry contact	P/S each 1	
13)	M/E control unit(card) failure	Dry contact	P/S each 1	
14)	Clutch control unit(card) failure	Dry contact	P/S each 1	
15)	Z-peller control unit(card) failure	Dry contact	P/S each 1	
16)	CPP control unit(card) failure	Dry contact	P/S each 1	
17)	M/E control handle position	Voltge	P/S each 1	
18)	M/E speed	Current	P/S each 1	
19)	Steering handle position	Voltge	P/S each 1	
20)	Steering unit position	Voltge	P/S each 1	
21)	CPP handle position	Voltge	P/S each 1	
22)	CPP unit position	Voltge	P/S each 1	

— at the end of specifications —



DIRECTION OF ROTATION.  
(VIEWING FROM THE STERN SIDE)  
ENGINE            STARBOARD    CLOCKWISE.  
                     PORT            CLOCKWISE.

使用先 ISSUED FOR 8L28HX			
摘要 DESCRIPTION/O.N. WE1. TP681 (450A), BE72 (150mm)		尺度 SCALE 1:25	
承認 APPD.	調査 REV.	担当 CHD.	製図 DWN.
高橋	絵畑	大塩	長谷川
新潟原動機株式会社 Niigata Power Systems Co., Ltd.		2006.12.25	

図番 DRAWING NO.  
75M00084B 1/1



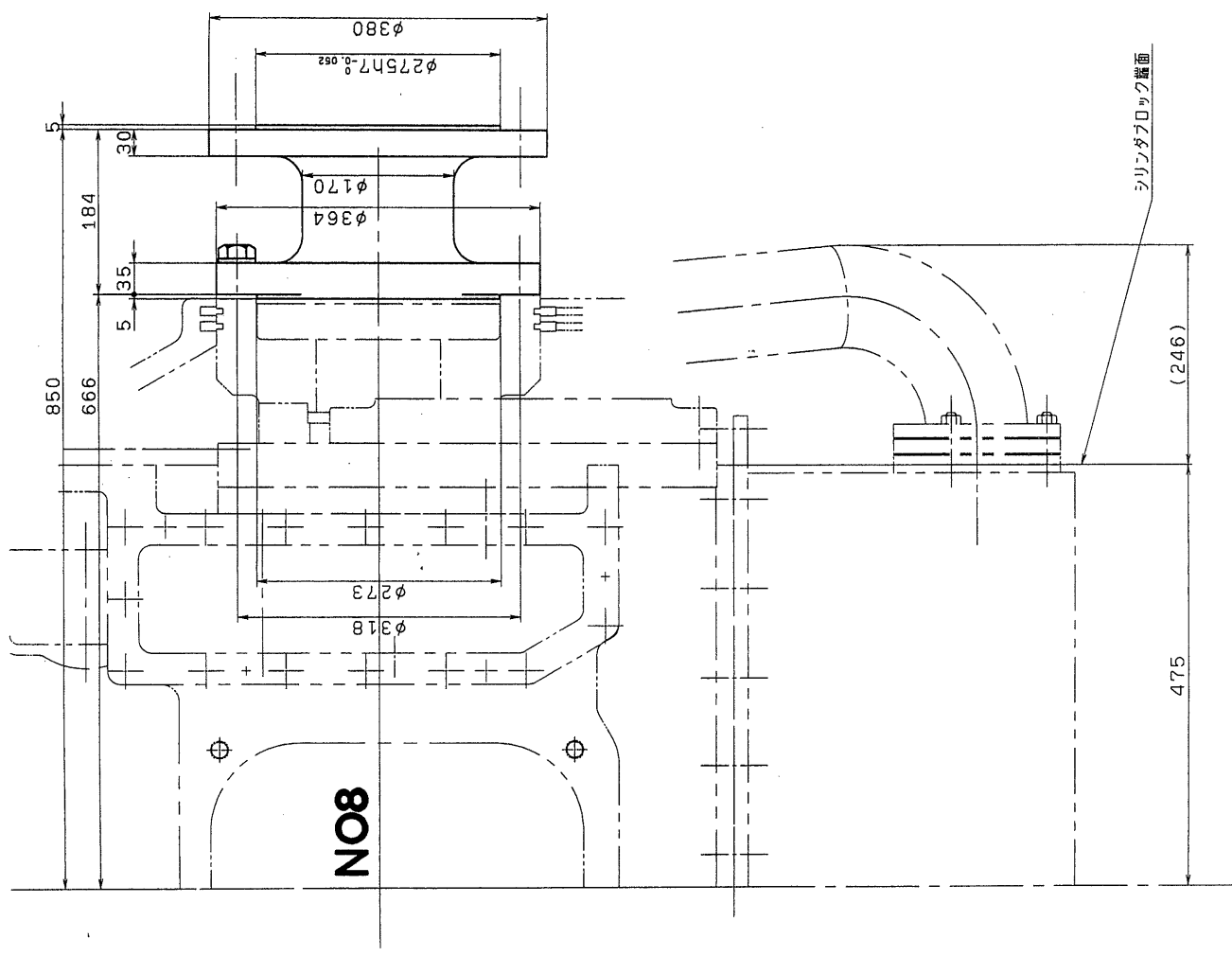
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図名	部品番号	部品名称	TITLE	材料	数量	単位	備考	検査	承認	承認	承認

2066

CD

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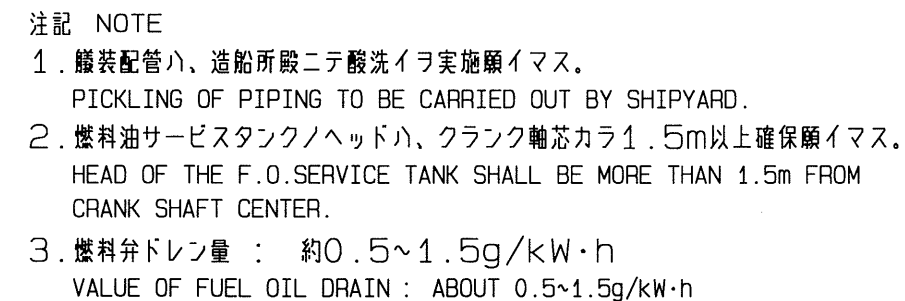
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2

3

№ 5 4

記号	来歴	REVISION	年月日	変更	照査	承認	△			
	△	△	部変更スル。	1999. 10. 25	本	木	国	府	田	新
凡 例 SYMBOL										
—	弊社配管	SHOP PIPING		✕	三方弁	THREE-WAY VALVE				
—	艦装配管	SHIPYARD PIPING		✕	減圧弁	PRESSURE REDUCING VALVE				
SUS	ステンレス鋼管	STAINLESS STEEL PIPE		✕	バタフライ弁	BUTTERFLY VALVE				
STS	鋼管	STEEL PIPE		—	伸縮管継手	EXPANSION JOINT				
C1220T	銅管	CUPPER PIPE		(P)	圧力計	PRESSURE GAUGE				
SGP	ガス管	GAS PIPE		(PS)	圧力スイッチ	PRESSURE SWITCH				
STPG	圧力鋼管	STEEL PIPE FOR PRESSURE SERVICE		(T)	温度計	THERMOMETER				
—	フランジ継手	FLANGED JOINT		△ (TS)	温度スイッチ	TEMPERATURE SWITCH				
—	閉止フランジ△	BLANK FLANGE		(F)	流量計	FLOW METER				
—	ニップル継手	SCREWED JOINT WITHOUT BOSS		←	機関駆動ポンプ	ENGINE-DRIVEN PUMP				
—	ターミナル継手	SCREWED JOINT WITH BOSS		(M) ↓	電動ポンプ	ELECTRIC-MOTOR DRIVEN PUMP				
—	ボス	BOSS		▨	単式こし	SIMPLEX STRAINER				
✕	玉形弁 (常時開)	STOP VALVE (NOMAL OPEN)		✕	複式こし	DUPLEX STRAINER				
✕	玉形弁 (常時閉)	STOP VALVE (NOMAL CLOSE)		—	空気槽	AIR VESSEL				
△	玉形弁 (アングル弁)	STOP VALVE (ANGLE TYPE)		▷	レジューサ	REDUCER				
—	主始動弁	STARTING MAIN VALVE		—	分離器	SEPARATOR				
✕	逆止弁	CHECK VALVE		—	冷却器	COOLER				
✕	安全弁	SAFETY VALVE		—	消音器	SILENCER				
✕	仕切弁	GATE VALVE		—	ヒータ	HEATER				
—	めがねフランジ	SPECTACLE FLANGE		—	空気抜管	AIR VENT PIPE				
—	二方コック	COCK		(NS)	弊社所掌	NIIGATA SUPPLY				
—	三方コック	THREE-WAY COCK		※	船体取付機器	INSTALLATION TO SHIP				
使用先 ISSUED FOR			⊙		図名 TITLE					
摘要 DESCRIPTION/O. N.			尺度 SCALE		諸管系統図記号表					
			NON		SYMBOL MARKS					
承認 APPD.	照査 REV.	担当 CHD.	製図 DWN.	年月日 DATE	図番 DRAWING NO.					
平	田	石	黒	霜	村	佐	藤	1989. 01. 26	24960-004A	
新潟原動機株式会社 Niigata Power Systems Co., Ltd.									24960-004A	

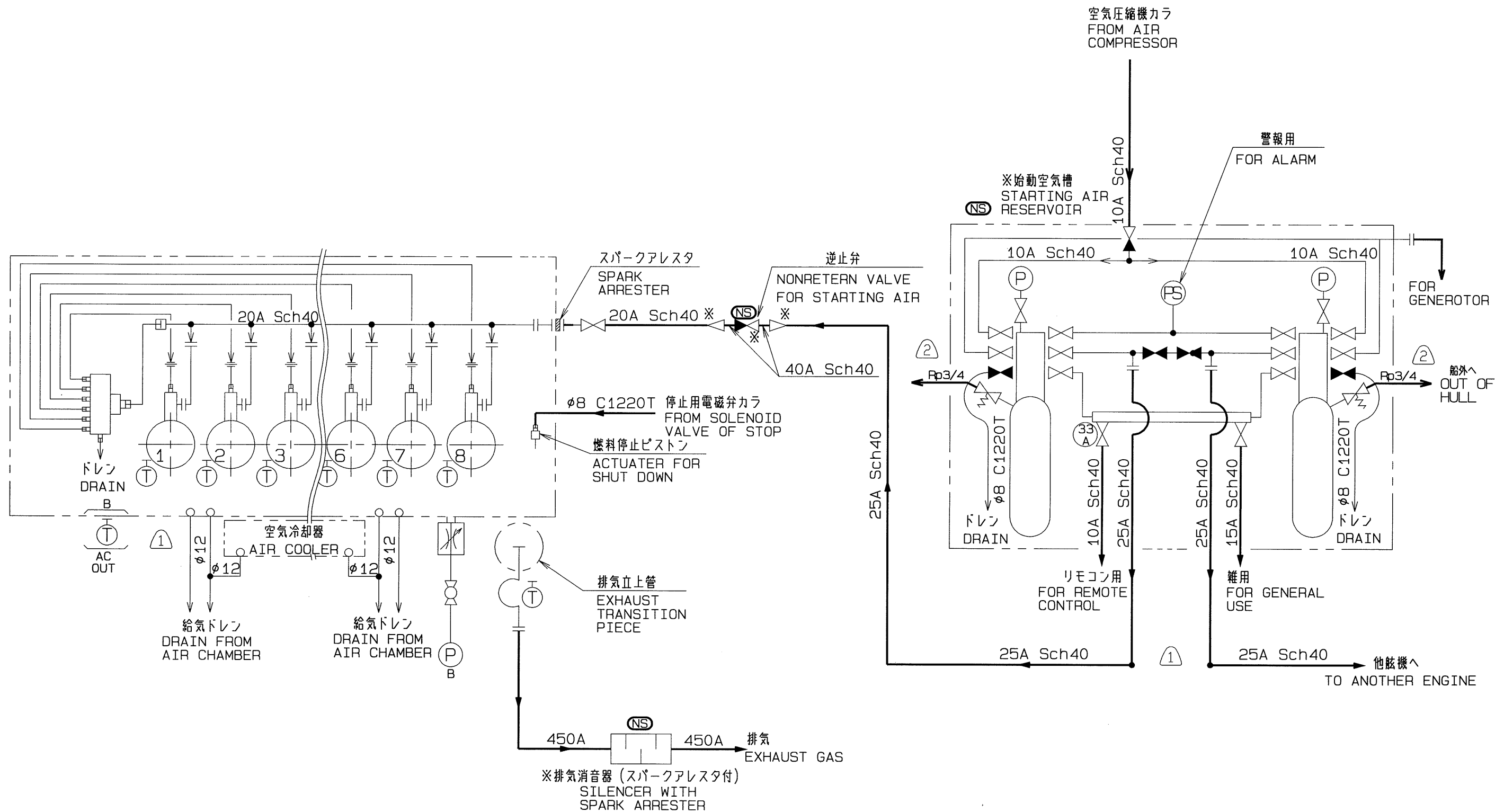


図名 TITLE  
 燃料油配管系統図  
 FUEL OIL PIPING DIAGRAM  
 図番 DRAWING NO.  
 85M02015A 1/6

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CAD

修正 修正確認 図番 DRAWING NO.



注記 NOTE  
1. 艤装配管ハ、造船所殿ニテ酸洗イラ実施願イマス。  
PICKLING OF PIPING TO BE CARRIED OUT BY SHIPYARD.

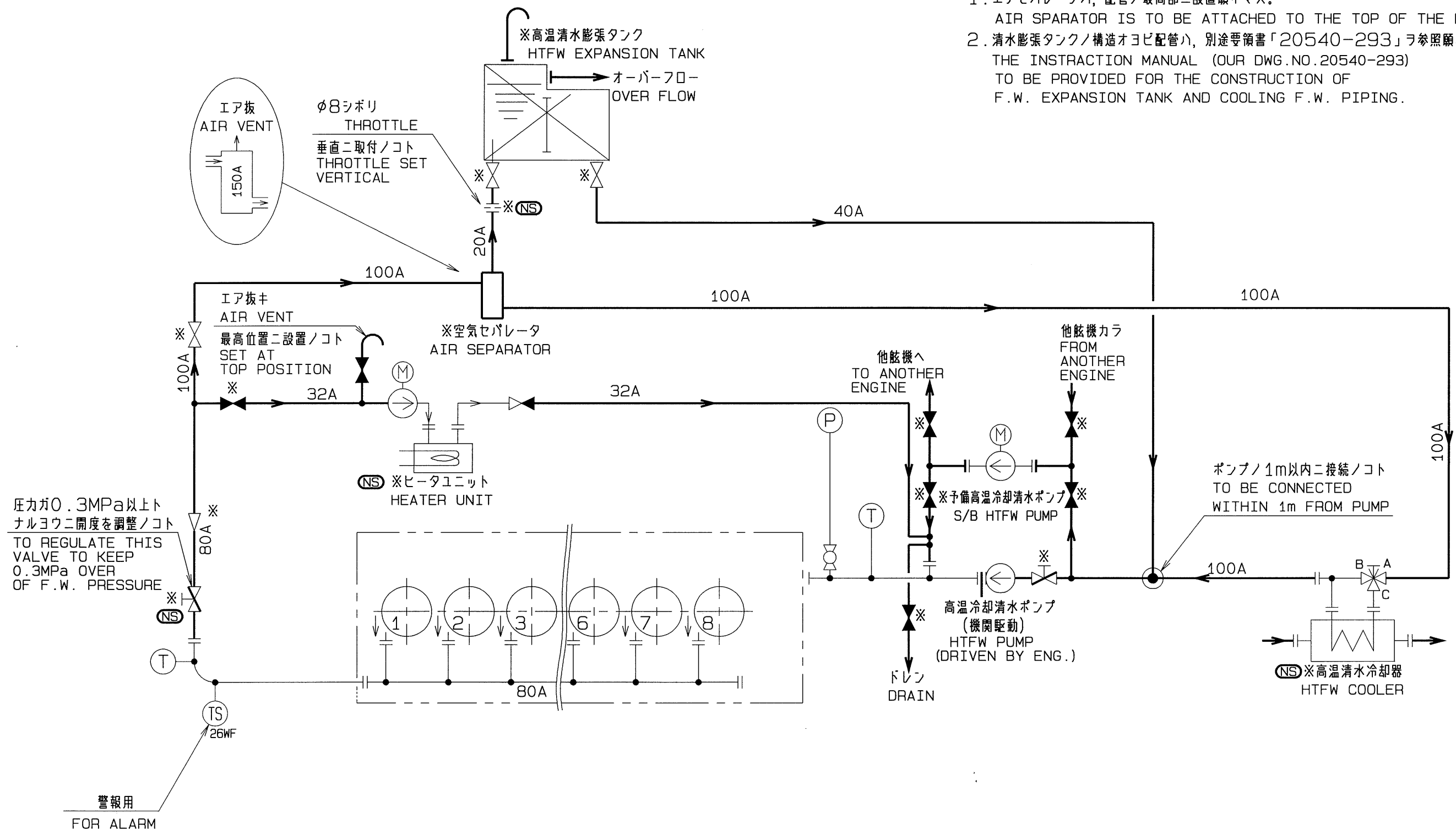
記号	来歴	REVISION	年月日	変更	照査	承認	使用先 ISSUED FOR	図名 TITLE
							8L28HX	始動空気・給気・排気配管系統図
							摘要 DESCRIPTION/O.N.	AIR & EXHAUST GAS PIPING DIAGRAM
							承認 APPD. 照査 REV. 担当 CHD. 製図 DWN. 年月日 DATE	図番 DRAWING NO.
							新潟原動機株式会社 Niigata Power Systems Co., Ltd.	85M02015A 2/6







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図番 DRAWING NO.  
修正 修正確認  
CAD



- 注記 NOTE
1. エアセパレータハ、配管ノ最高部に設置願イマス。  
AIR SPARATOR IS TO BE ATTACHED TO THE TOP OF THE PIPING.
  2. 清水膨張タンクノ構造オヨビ配管ハ、別途要領書「20540-293」ヲ参照願イマス。  
THE INSTRUCTION MANUAL (OUR DWG.NO.20540-293) TO BE PROVIDED FOR THE CONSTRUCTION OF F.W. EXPANSION TANK AND COOLING F.W. PIPING.

記号	来歴	REVISION	年月日	変更	照査	承認
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△						
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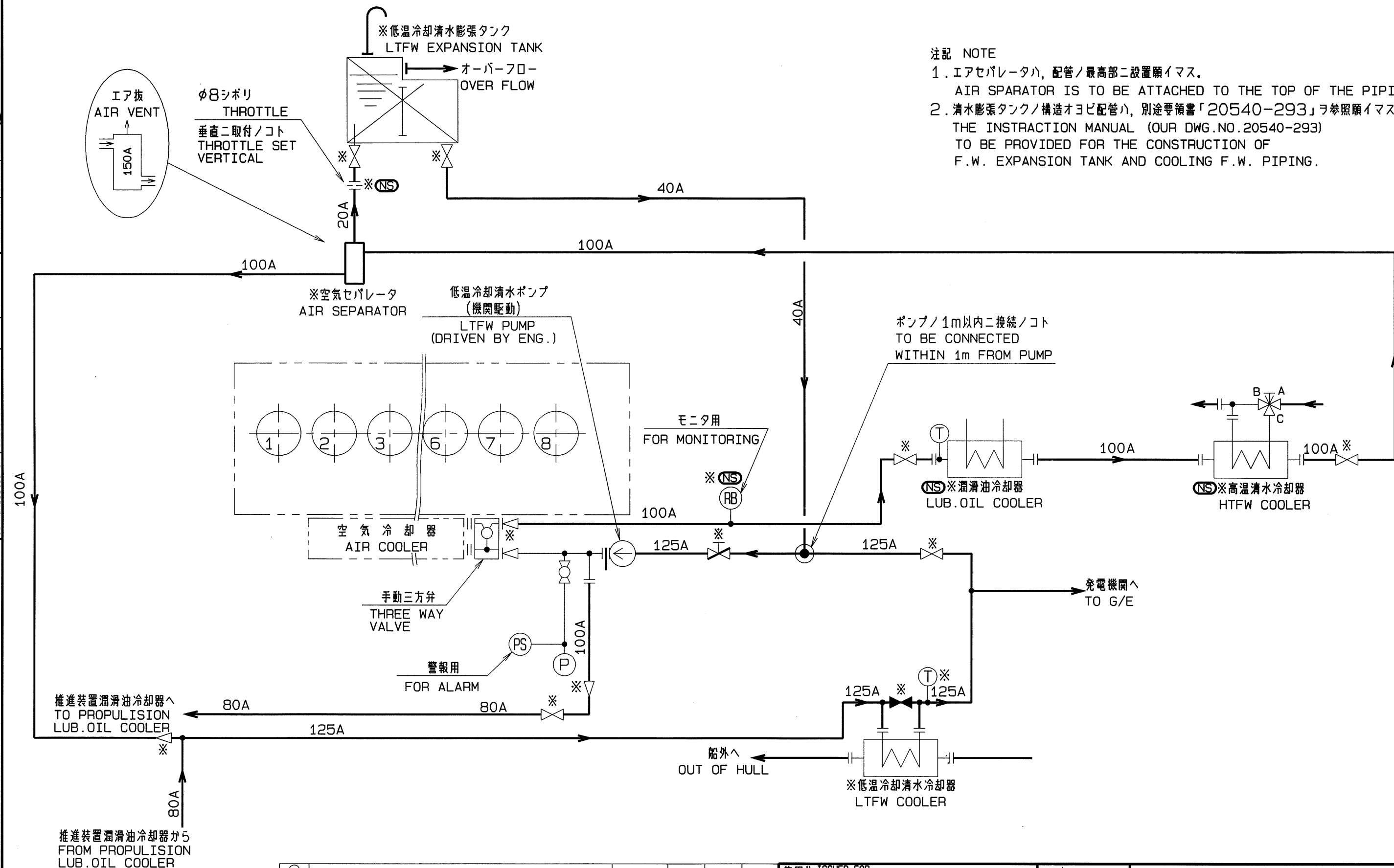
使用先 ISSUED FOR		8L28HX		 	
摘要 DESCRIPTION/O.N.				尺度 SCALE NOT	
承認 APPD.	照査 REV.	担当 CHD.	製図 DWN.	年月日 DATE	
新潟原動機株式会社 Niigata Power Systems Co., Ltd					

図名 TITLE	高温冷却水配管系統図 H.T.F.W. PIPING DIAGRAM
図番 DRAWING NO.	85M02015A 4/6

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修正 修正確認 図番 DRAWING NO.

CAD



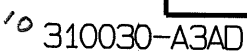
注記 NOTE

1. エアセパレータハ、配管ノ最高部ニ設置願イマス。  
AIR SPARATOR IS TO BE ATTACHED TO THE TOP OF THE PIPING.
2. 清水膨張タンクノ構造オヨビ配管ハ、別途要領書「20540-293」ヲ参照願イマス。  
THE INSTRUCTION MANUAL (OUR DWG. NO. 20540-293) TO BE PROVIDED FOR THE CONSTRUCTION OF F.W. EXPANSION TANK AND COOLING F.W. PIPING.

記号	来歴	REVISION	年月日	変更	照査	承認
△						
△						
△						
△						
△						

使用先 ISSUED FOR	8L28HX	図名 TITLE	低温冷却水配管系統図
摘要 DESCRIPTION/O.N.		尺度 SCALE	NOT
承認 APPD.	照査 REV.	担当 CHD.	製図 DWN.
年月日 DATE			
新潟原動機株式会社 Niigata Power Systems Co., Ltd.			

図番 DRAWING NO.	85M02015A 5/6
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**NIGATA**

CLASS No.	_____
SUB. No.	_____

MODEL	CG-FLG32	DRAWING No.	879 06113B
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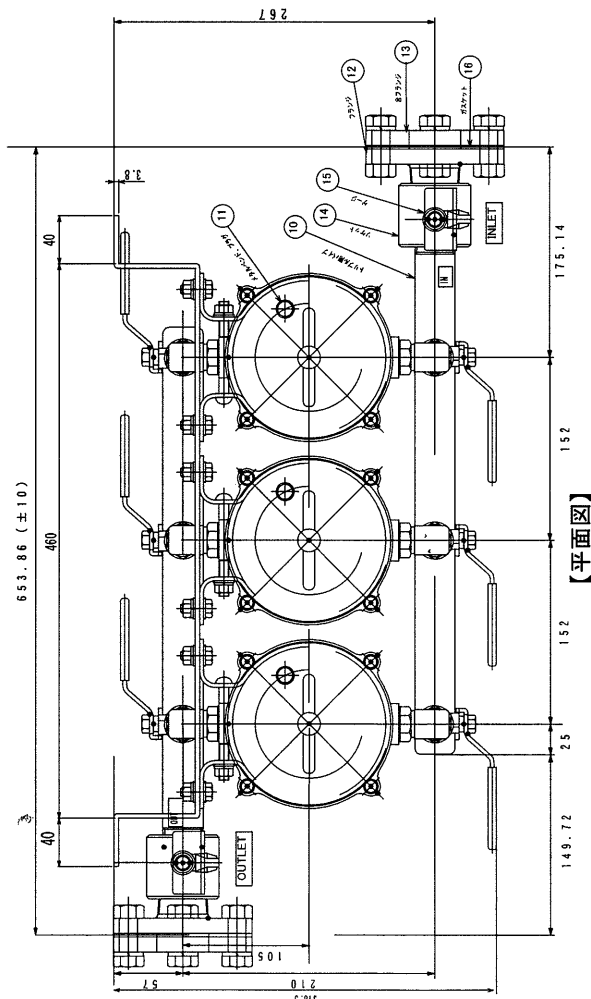
**FUEL OIL FILTER****燃料油こし器**

CLEANING METHOD	:	
FILTER AREA	:	APPROX. 11880cm <sup>2</sup> × 3
FILTRATING LIMIT	:	30 μ
PIPING DIA.	:	32A
MASS	:	APPROX. 25 kg

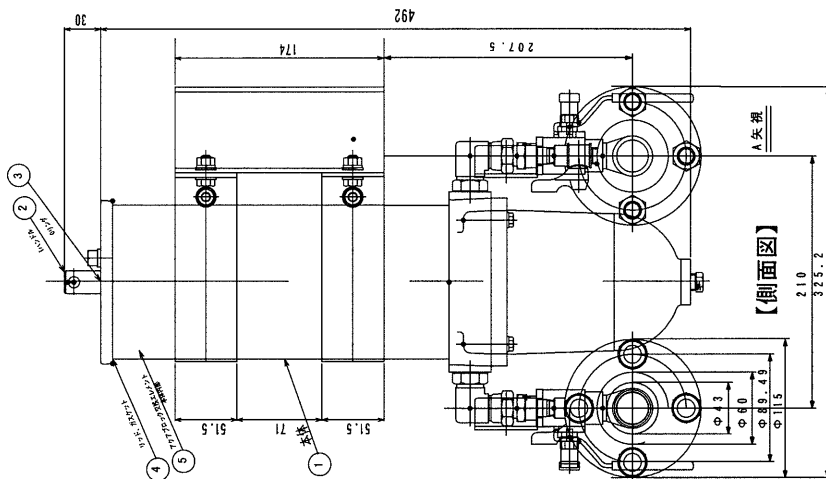
<b>B</b>	指示票 K79-288二ヨル	<i>S. Minami</i>	<i>S. Minami</i>	T. Kudou	23-Oct-07
MARK	REVISION	APPROVED	PASSED	DRAWN	DATE
<b>Niigata Power Systems Co., Ltd.</b> ENGINEERING & TECHNOLOGY CENTER			APPROVED	<b>S. Minami</b>	
			PASSED	<b>S. Minami</b>	
			CHECKED	<b>T. Tokitou</b>	
			DRAWN	<b>T. Tokitou</b>	
			DATE	2002/12/17	

型式 79/1000FHM VNT-32  
 混合油種 軽油/A重油  
 ポートねじ NP11  
 最大処理流量 2044L/時間  
 質量 約25kg (乾燥時)  
 最大圧力 103kPa  
 圧損 17.2kPa  
 濾油精度 30μ  
 濾油速度 1180 ccf エレメント1本  
 濾過面積 99%以上 25PPM以下  
 水分分離性能 -0.1MPa ~ 0.4MPa  
 圧力計 精度±1.6%  
 グリセリン入り  
 メーカー標準

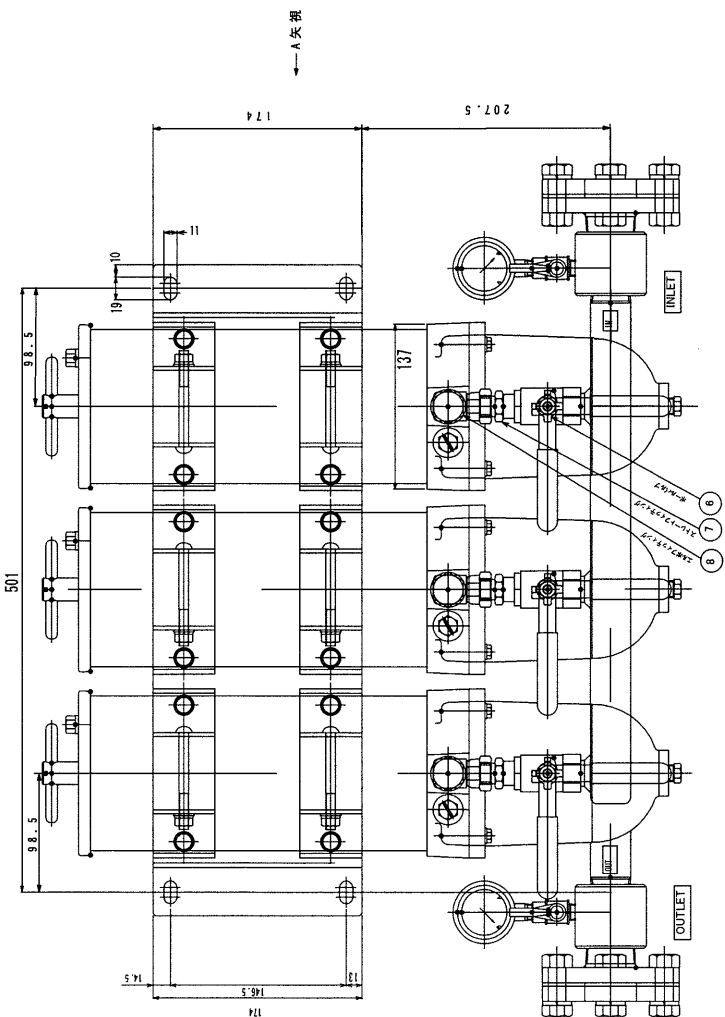
MODEL 791000FHM VNT-32  
 OIL TYPE DIESEL  
 PORT SIZE NTP 1"  
 MAXIMUM FLOW RATE 2044 LITER PER HOUR  
 WEIGHT 540 kg  
 (dry) 55.11 lbs  
 MAXIMUM OPERATING PRESSURE 103kPa  
 15PSI  
 CLEAN PRESSURE 17.2kPa  
 2.5PSI  
 PROPORTION EFFICIENCY 30 MICRON  
 FILTRATION AREA SEPARATOR OVER 99%  
 UNDER 25PPM  
 PRESSURE GAGE ACCURACY ±1.6%  
 GLYCERIN  
 COLOR MANUFACTURE S  
 COATING STANDARD



【平面図】



【側面図】



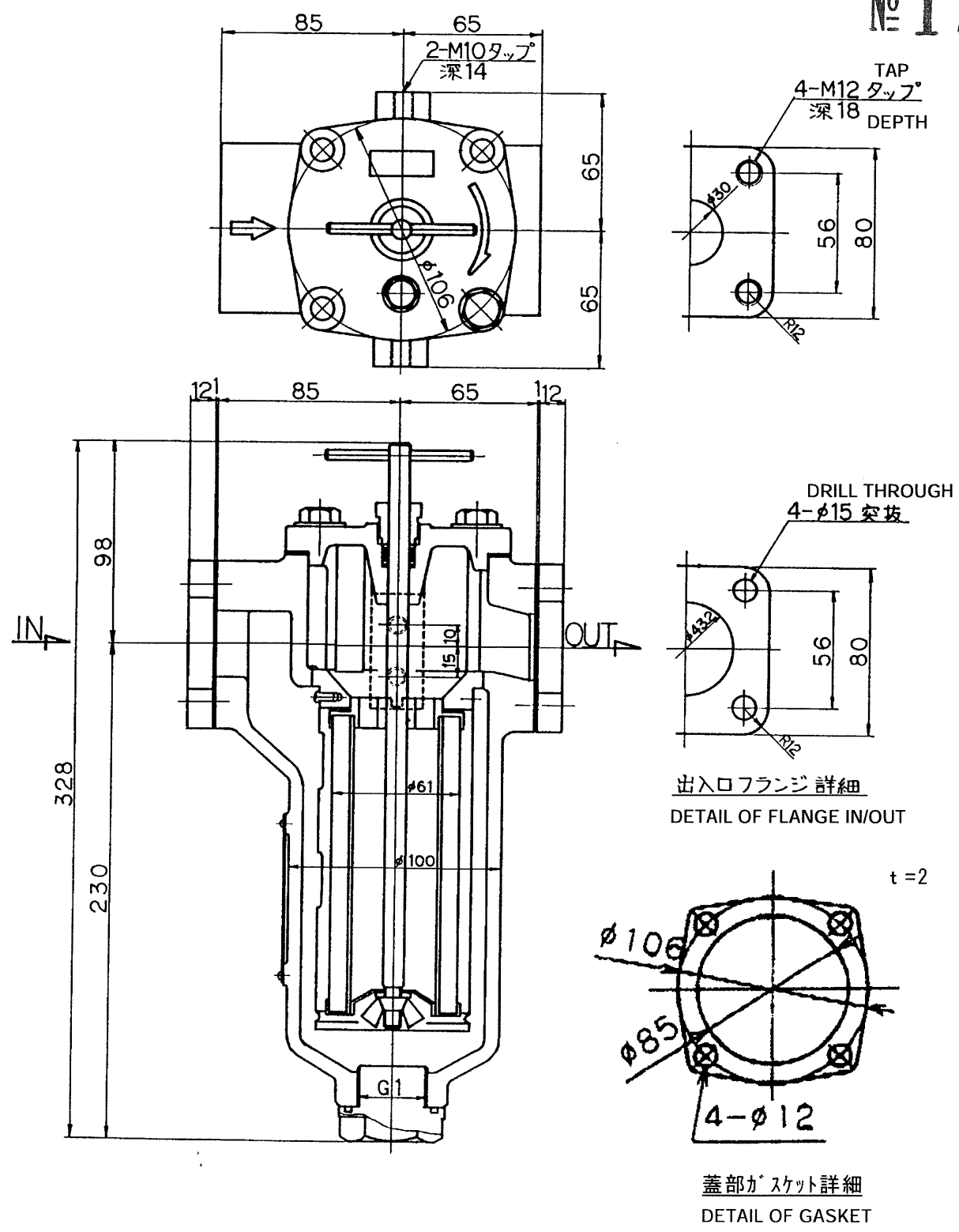
【正面図】

16	ガスケット	2	SK-32A (E05146) GASKET
15	ゲージ	2	4-5MM (0.1971) GAGE GLYCERIN
14	フランジ	2	4-5MM (0.1971) SOCKET
13	フランジ	2	SS400 SK-32A FLANGE BOLT NUT
12	フランジ	2	SS400 SK-32A FLANGE
11	メタルベンドプラグ	3	RK10110 VENT PLUG
10	ドレン コック	2	11076 PIPE
9	ドレン コック	3	RK12000 DRAINCOCK
8	エルボー フッティング	6	11072 ELBOW FITTING
7	ストレート フッティング	6	11074 STRAIGHT FITTING
6	ボールバルブ	6	RK11073 BALL VALVE
5	7/8" (20.315) 28x1.5mm ELEMENT	3	2020PM-08 ELEMENT
4	リップド、ガスケット	3	11007 (999311050) LIPS GASKET
3	Tハンドル用リング	3	11350 (999311050) T-HANDLE O-RING
2	Tハンドル	3	RK11888 T-HANDLE
1	レイコ本体	3	1000FHM MAG FLOWMETER SPANISH
部品名 数量 部品番号 DESCRIPTION			
図	07.07.20	承認	検 作 図 早坂
尺図		型式	RAC0879/1000FHM-VNT 06-FL02
		図番	RFNS-79/1000FHM-14
		株式会社	スターファイブ

記号	来歴	REVISION	年月日	変更	照査	承認	△				
△							△				

No. 12 A

修正確認図番 C79 01791A  
修正  
CAD  
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3 2 5 MESH

使用先 ISSUED FOR オートクリーンタイプ (W79 01012A)				図名 TITLE 燃料油濾器 (NU-08) FUEL OIL FILTER	
摘要 DESCRIPTION/O. N.				尺度 SCALE NOT	
承認 APPD. 平田	照査 REV. 清水	担当 CHD. 霜村	製図 DWN. 岩井	年月日 DATE 1988.03.10	図番 DRAWING NO. C79 01791A
新潟原動機株式会社 Niigata Power Systems Co., Ltd.					

№ 13

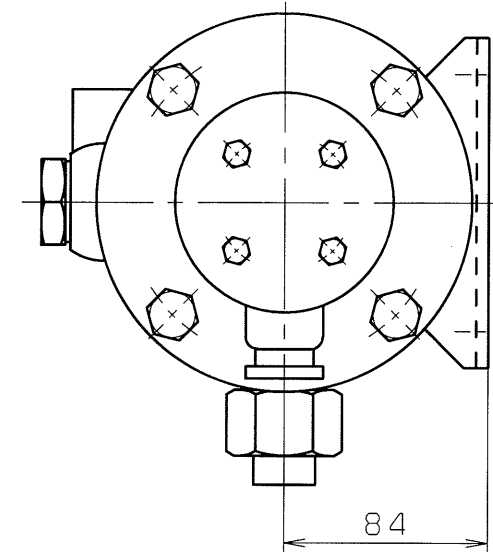
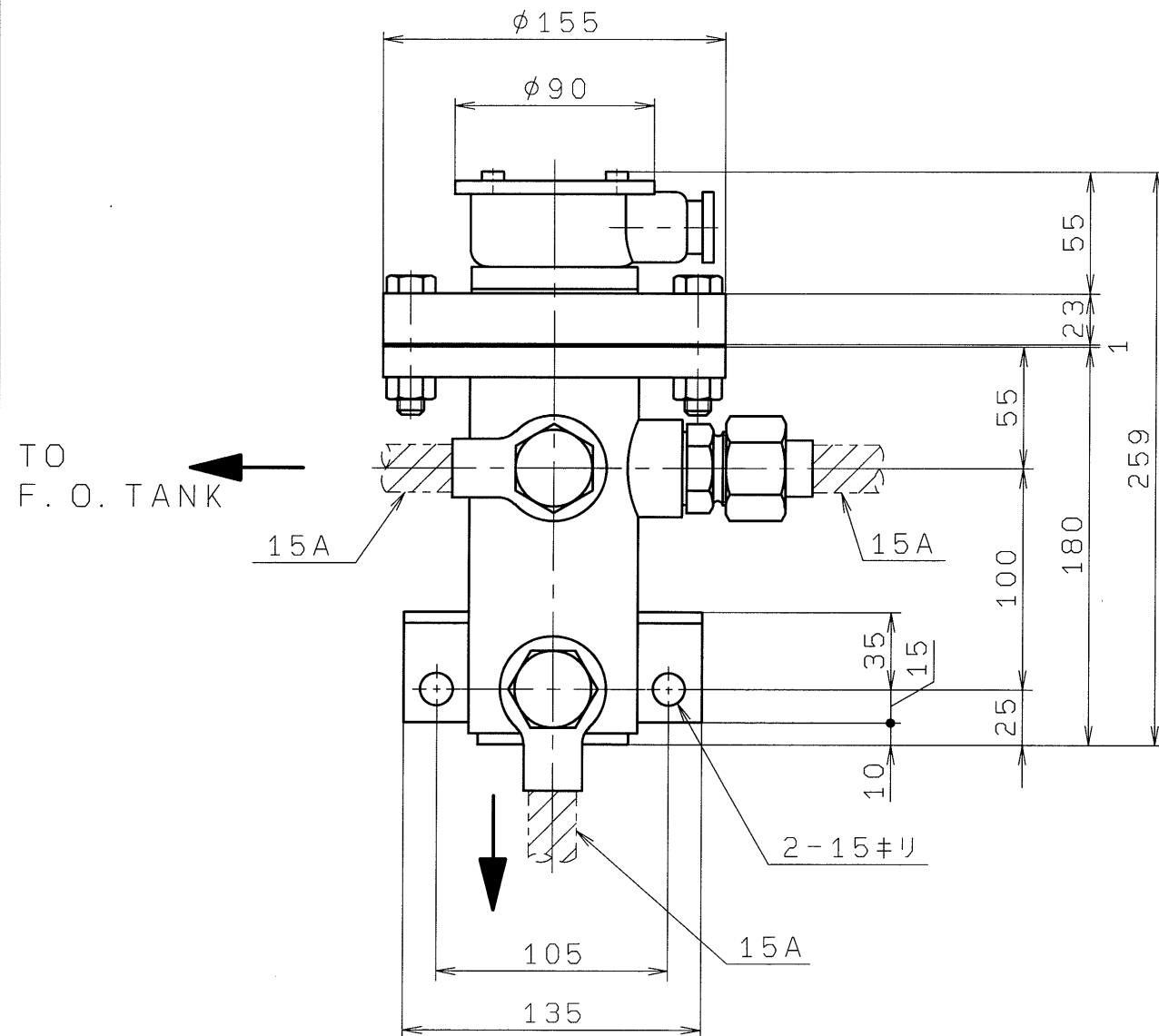
修正確認 図番 DRAWING NO.

## 修正

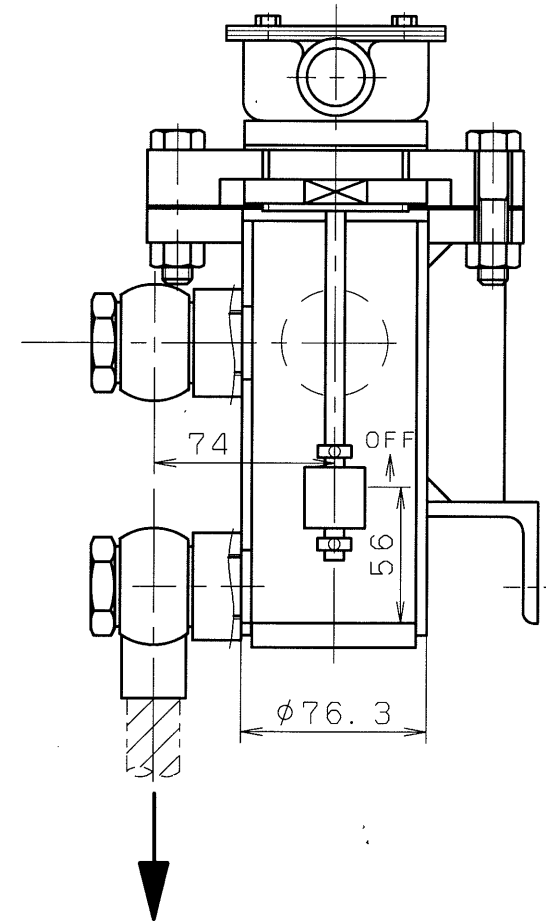
# CAD

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原図	縮小率
A3	%



FROM  
ENG.



TO F.O. TANK

削り加工寸法の普通許容差										材質 MATERIAL など ETC. 別記			質量 MASS				図名 TITLE			
寸法区分 表面粗さ(Ra)										摘要 DESCRIPTION/O.N. レベルスイッチ付					尺度 SCALE 1:2.5		FOOウユタンククミタテ F.O. LEAKAGE OIL TANK			
を越え 以下										承認 APPD. 照査 REV. 担当 CHD. 製図 DWN. 年月日 DATE										
0.5	3	±0.1	CAD化シ調整スル。							2002.05.21				1	南	南	大塩	時任	2002.05.21	図番 DRAWING NO. C78708017A
3	6	±0.2	記号 来歴 REVISION							年月日	変更	照査	承認	使用先 ISSUED FOR	数/台 NO./OFF.					
6	30	±0.5	指示外 O. 2系面取							参照図番 REFERED DRW.			変更後図 AFTER			変更前図 BEFORE				
30	120	±0.8	0.2mm CHAMFERING FOR NON INDICATED PART													新潟原動機株式会社 技術センター Niigata Power Systems Co., Ltd.				



CLASS No.	_____
SUB. No.	_____

MODEL		DRAWING No.	886 05018A
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№ 21

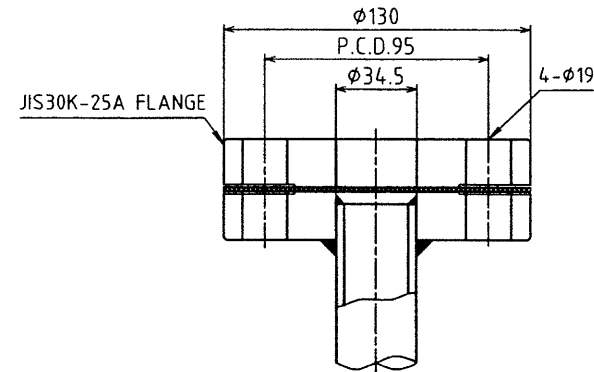
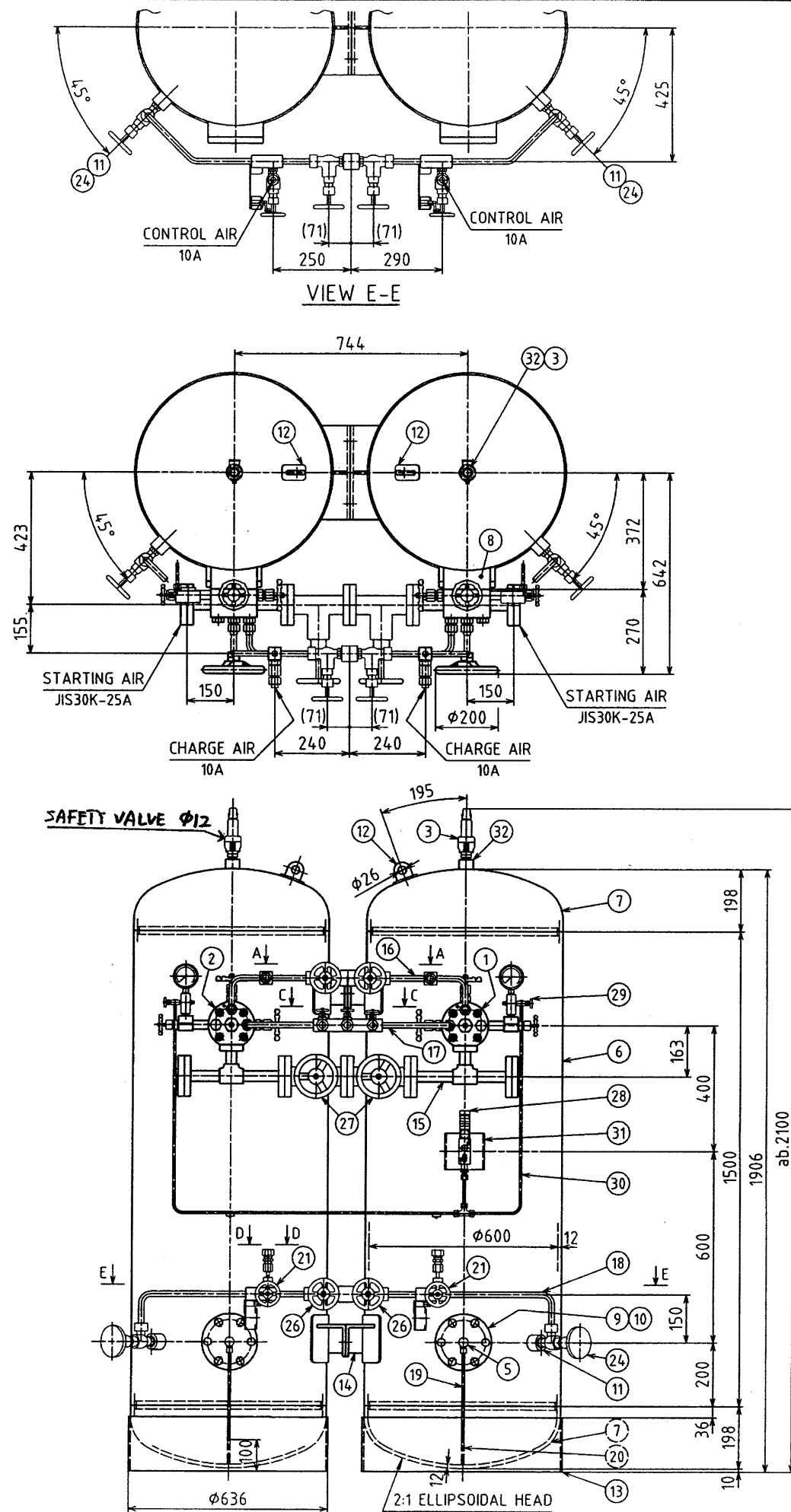
AIR TANK

始動空気槽

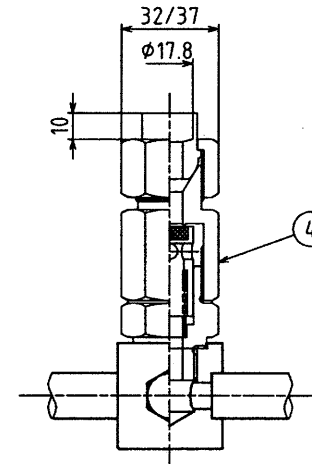
RULE : ABS他(LRS以外)  
TYPE : 主機起動用  
SPECIFICATION : 500L × 2 / 3.0MPa  
DP-2  
安全弁 外部配管

MARK	REVISION	APPROVED	PASSED	DRAWN	DATE
<b>Niigata Power Systems Co., Ltd.</b> ENGINEERING & TECHNOLOGY CENTER			APPROVED	<b>S. Takahashi</b>	
			PASSED	<b>S. Takahashi</b>	
			CHECKED	<b>Y. Oshio</b>	
			DRAWN	<b>S. Kanai</b>	
			DATE	26-Feb-08	

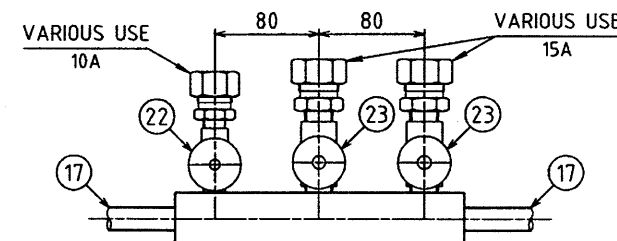




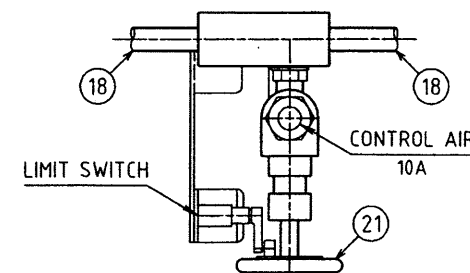
DETAIL OF FLANGE FOR STARTING AIR



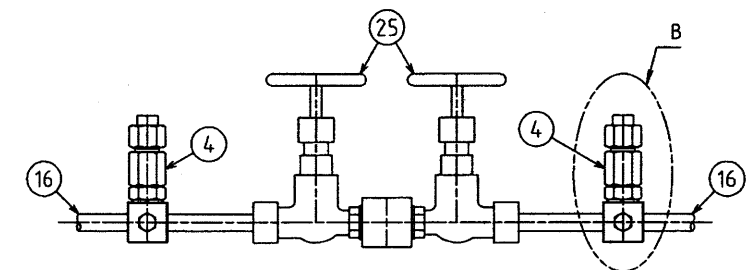
DETAIL OF "B"



DETAIL OF AUX. AIR PIPE  
(VIEW C-C)



DETAIL OF CONTROL AIR  
(VIEW D-D)



DETAIL OF CHARGE AIR PIPE  
(VIEW A-A)

PARTICULAR FOR AIR RESERVOIR	
WORKING PRESSURE	3.0 MPa
DSIGN PRESSURE	3.2 MPa
HYD. TEST PRESSURE	4.8 MPa
WEIGHT	900 kg

No.	DESCRIPTION	MATERIAL	No. OF REQ.	REMARKS	PARTS No.
1	HEADER VALVE	-	1		
2	HEADER VALVE	-	1		
3	SAFETY VALVE	SUS304	2	Rc3/4 Φ12	98616024A
4	NORETURN VALVE	C3604BD	2	G1/2 Φ17.8	P8640248A
5	DRAIN VALVE	C3604BD	2	Φ8	
6	SHELL PLATE	SPV315	2		
7	END PLATE	SPV315	4		
8	HEADER VALVE SEAT	SF440A	2		
9	HAND HOLE	SF440A	2		
10	HAND HOLE COVER	SF440A	2		
11	CONTROL AIR ROOT V.S.	S25C	2	M24×2	
12	HANGING LUG	SM400	2	0.5tons	
13	SUPPORT SADDLE	SM400	2		
14	SUPPORTER	SM400	4		
15	STARTING AIR PIPE	STPG370	1	Sch40×25A	
16	CHARGE AIR PIPE	STPG370	1	Sch40×10A	
17	AUX. AIR PIPE	STPG370	1	Sch40×10A	
18	CONTROL AIR PIPE	STPG370	1	Sch40×10A	
19	DRAIN OUTER PIPE	C1220T	2	Φ8×t1	
20	DRAIN INNER PIPE	C1220T	2	Φ8×t1	
21	CONTROL AIR VALVE	SF440A	2	JIS F 7337 FLA006SC	
22	VARIOUS USE VALVE	C3604BD	1	10A	
23	VARIOUS USE VALVE	C3604BD	2	15A	
24	CONTROL AIR ROOT VALVE	SF440A	2	JIS F 7337 FLA010SS	
25	SWITCHING VALVE (FOR CHARGE AIR)	SF440A	2	JIS F 7336 FGA010SS	
26	SWITCHING VALVE (FOR CONTROL AIR)	SF440A	2	JIS F 7336 FGA010SS	
27	SWITCHING VALVE (FOR STARTING AIR)	SF440A	2	JIS F 7336 FGA025F	
28	PRESS. SWITCH	-	1	FOR ALARM (WITH TEST COCK)	98210205B
29	P.S. ROOT VALVE	-	2		
30	P.S. PIPE	C1220T	1	Φ8×t1	
31	P.S. BOARD	SS400	1	125×115	
32	SAFETY VALVE SEAT	S25C	2	Rc3/4	

\* PRESS. SWITCH...SET PRESS. OFF:1.5MPa BELOW

NIIGATA DRG. No.		88605018A	
SHIP No.		OWNER	
WORK No.		NIIGATA POWER SYSTEMS CO., LTD.	
RULE	ABS	500 L × 3.0 MPa	
HEAD	T.SHIMADA	STARTING AIR RESERVOIR	
CHECKED	T.S.	HEMMI IRON WORKS CO., LTD.	
CHARGE	N.YAMAMOTO	DESIGN SECTION	
DRAWN	N.Y.	株式会社 設計課	
SCALE	1:12		
DATE	2007/12/20		
MFR'S No.		DRAWING No.	H-31632

1

2

3

4

記号 来歴 REVISION

年月日

変更 照査 承認

△

△

図番 DRAWING NO.

C98 22133A

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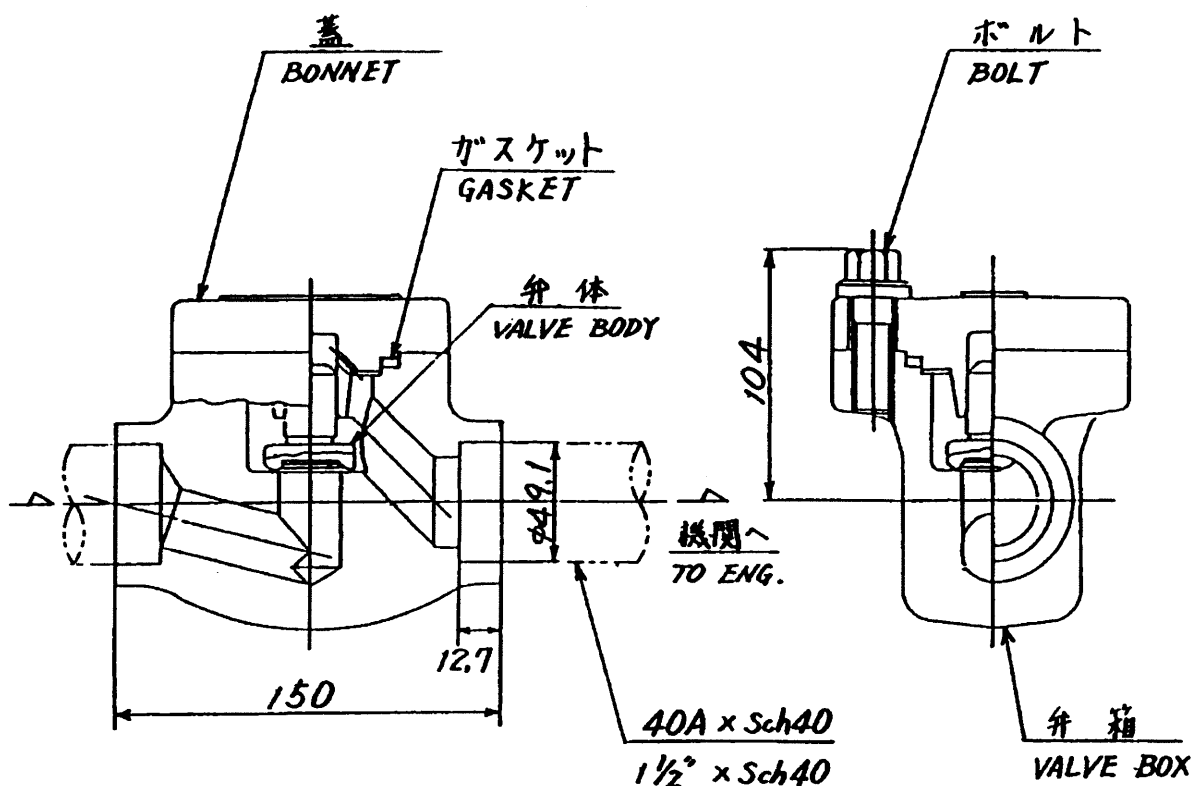
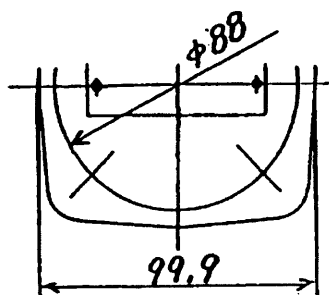
No 22

## 主要部材質 MATERIAL

弁箱 VALVE BOX : SFVC2A

蓋 BONNET : SFVC2A

弁体 VALVE BODY : SUS420J2

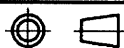


注 : 逆止弁取付ノ際ハ 蓋ガ上部ニナル様 取付下サイ

CAUTION : AT PIPING, PLEASE TURN THE BONNET OF NONRETURN VALVE UPSIDE.

使用先 ISSUED FOR

各型 ( 398 32021A )



図名 TITLE

摘要 DESCRIPTION/O. N.

40A用

尺度 SCALE  
NOT

始動空気逆止弁

承認 APPD.

照査 REV.

担当 CHD.

製図 DWN.

年月日 DATE

NONRETURN VALVE

清水

清水

新井

安羅岡

1990.03.16

図番 DRAWING NO.

新潟原動機株式会社 Niigata Power Systems Co., Ltd.

C98 22133A

1

2

3

№ 3 1 4

記号 A	来歴 REVISION	年月日 1992. 01. 31	変更 長谷川	照査 -	承認 △	550A 要目追記.	1994. 05. 27	川 岸 宮 本

図番  
C9124029B<sup>1/1</sup>

修正確認  
修正  
CAD

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250 (取付寸法)  
SETTING LENGTH

51 138 51

C 46 46 C

DRILL  
D-E ± 0.15

φB

φA

15 40 40

取付完了後、取除ク事。  
TO BE REMOVED AFTER  
COMPLETION OF PIPING WORK.

注. ΔXmm (軸方向変位量 AXIAL MOVEMENT ALLOWANCE)							
SIZE	A	B	C	D-E	ΔX	WEIGHT(Kg)	DRAWING NO.
250A	φ385	φ345	22	12-23	±15	25.5	89124023A
300A	φ430	φ390	22	12-23	±22	28.0	89124024A
350A	φ480	φ435	24	12-25	±22	36.0	89124025A
400A	φ540	φ495	24	16-25	±22	43.0	89124026A
450A	φ605	φ555	24	16-25	±22	53.0	89124027A
500A	φ655	φ605	25	20-25	±20	59.5	89124028A
550A	φ660	φ620	16	16-23	±20	50.4	89126005A

使用先 ISSUED FOR 各機関		図名 TITLE 排気伸縮継手 EXHAUST EXPANSION JOINT	
摘要 DESCRIPTION/O. N. 200A~550A (B)		尺度 SCALE 1:4	
承認 APPD. 松 浦 宮 本 岩 井 長谷川	照査 REV.	担当 CHD.	年月日 DATE 1992. 01. 31
新潟原動機株式会社 Niigata Power Systems Co., Ltd.		図番 DRAWING NO. C9124029B <sup>1/1</sup>	



CLASS No.	—
SUB. No.	—

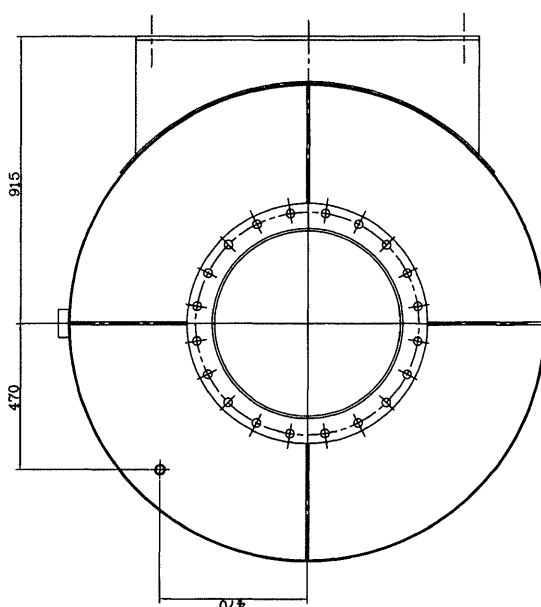
MODEL	SKD-600S	DRAWING No.	891 15629A
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## EXHAUST GAS SILENCER WITH SPARK ARRESTOR


排気消音器 \* スパークアレスタ付

ENG. MODEL : 8L28HX (2206kW用)  
 PIPING DIA. : 600A  
 AMOUNT OF ATTENUATION : 35dB(A)  
 DIRECTION OF INSTALLATION : VERTICAL

MARK	REVISION	APPROVED	PASSED	DRAWN	DATE
<b>Niigata Power Systems Co., Ltd.</b> ENGINEERING & TECHNOLOGY CENTER			APPROVED	<b>S. Takahashi</b>	
			PASSED	<b>S. Ehata</b>	
			CHECKED	<b>Y. Oshio</b>	
			DRAWN	<b>T. Kudou</b>	
			DATE	21-Sep-07	



A - A

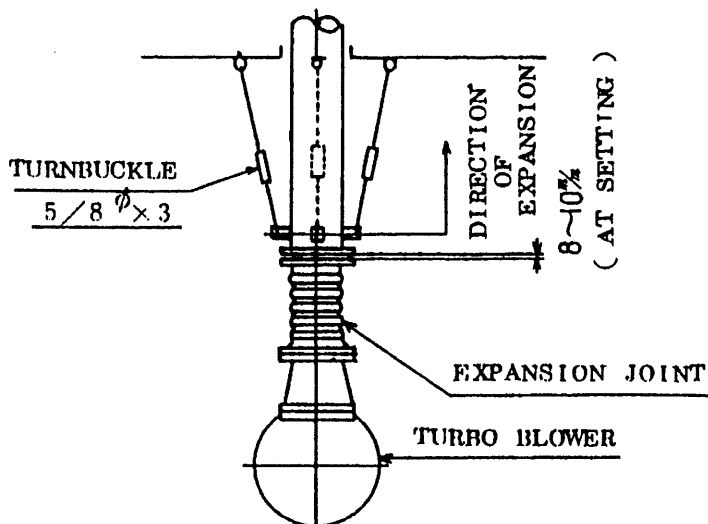
APPROVAL	CHECK	DRAWN	TYPE	SKD-600S SPARK-KILLER Niigata Power Systems Co.,Ltd
		DATE '07.9.20		
		SCALE 1/15		
 HARIMA TECHNOS CO.LTD			DWG.No 06-929-T2	

THE PROCEDURE FOR SETTING OF THE EXPANSION JOINT  
AT THE TURBO BLOWER EXHAUST GAS OUTLET  
SET THE EXPANSION JOINT IN CONSIDERATION OF  
THERMAL EXPANSION, TARE AND VIBRATION AS FOLLOWS.

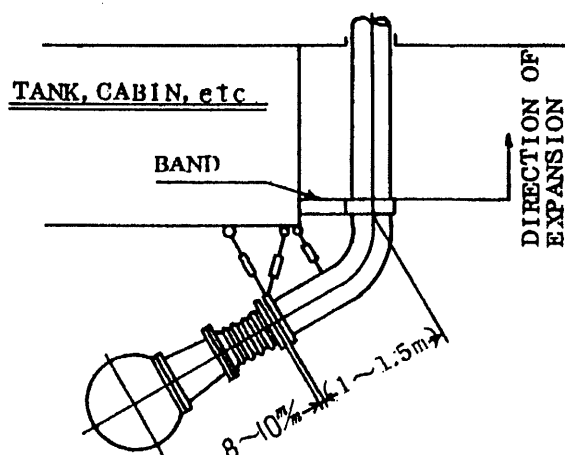
CLASS No  
20540

031A

VERTICAL EXHAUST PIPE



CROSSWISE SHORT AND INCLINED EXHAUST PIPE

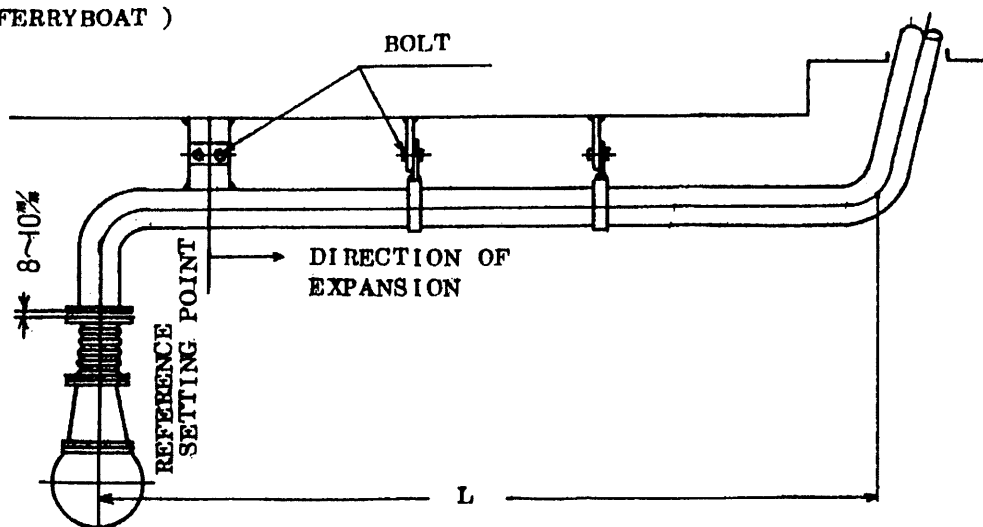


CAUTION

AT ENGINE RUNNING,  
RECLAMP THE SETTING  
SCREWS OF EXPANSION  
JOINT AFTER LOOSEN  
THEM IN ORDER TO  
REMOVE THE EXPANSION  
STRAIN OF THE EXHAUST  
PIPE

CROSSWISE LONG EXHAUST PIPE

( MORE AT FERRYBOAT )



REMARK

DATE

DR NO.

NIIGATA POWER SYSTEMS CO., LTD.

記号 来歴 REVISION

年月日

変更 照査 承認

注 1. 機関一機の場合; RC-100を納入します。

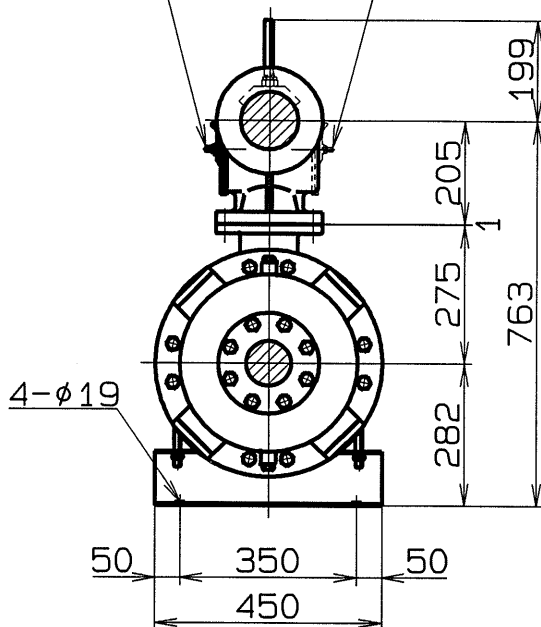
2. 機関二機の場合; RC-100, LC-100を各1組納入します。

NOTE 1. IN CASE OF ONE ENGINE; SUPPLY RC-100.

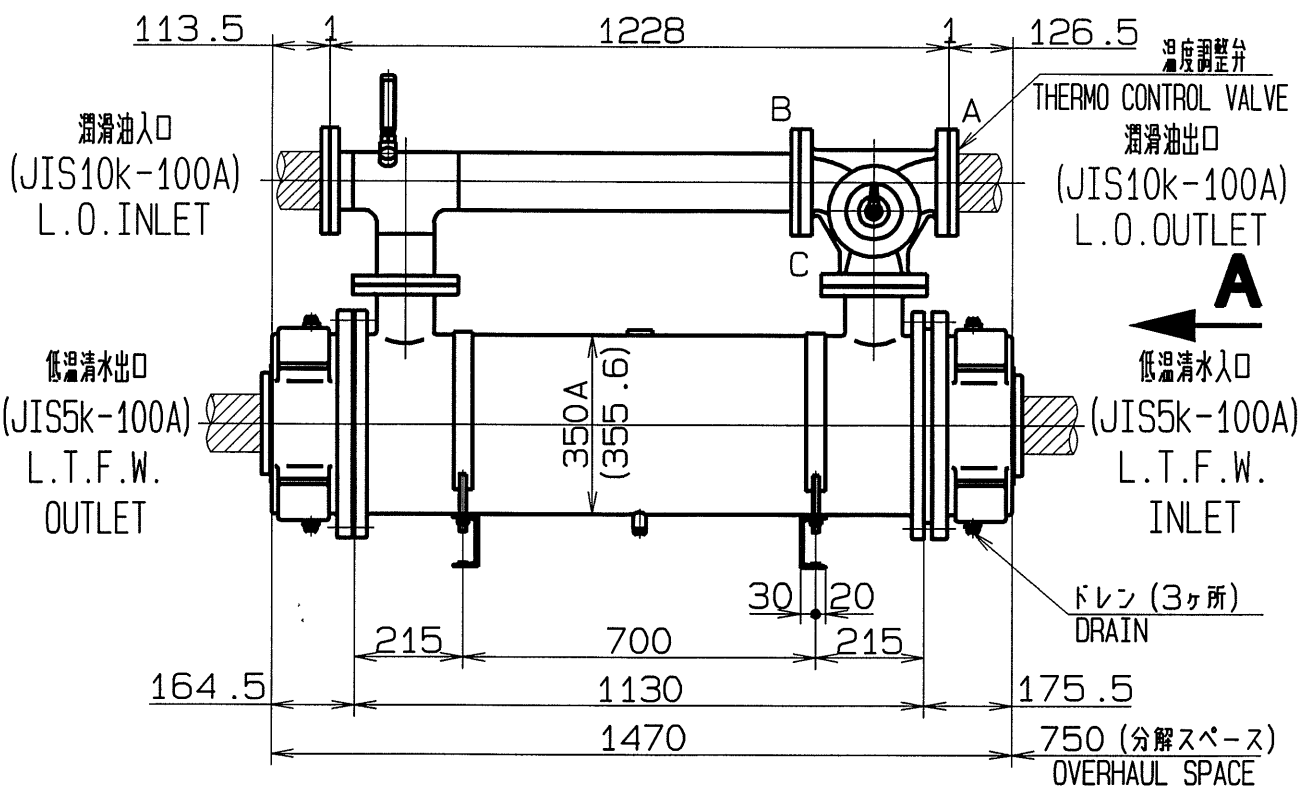
2. IN CASE OF TWO ENGINES; SUPPLY RC-100 &amp; LC-100.

LC-100

RC-100

**A**要目  
PARTICULARS

冷却面積 COOLING SURFACE	35 m <sup>2</sup>
冷却管長さ TUBE LENGHT	1164 mm
冷却管数 NO. OF TUBE	323
冷却管径 X 厚さ TUBE DIA & THICKNESS	12.7×1.24 mm
冷却管材質 MATERIAL OF TUBE	C1220T
容 量 VOLUME	潤滑油 LIB.OIL 約 80 L
	低温清水 L.T.F.W 約 50 L
質 量 MASS	乾 燥 DRY 約 448 kg
	運転時 FULL 約 578 kg

**№ 41**

使用先 ISSUED FOR

摘要 DESCRIPTION/O.N.

YL 35-3505F LC-100 (RC-100)

尺度 SCALE  
1: 15

承認 APPD.

照査 REV.

担当 CHD.

製図 DWN.

年月日 DATE

新潟原動機株式会社 Niigata Power Systems Co., Ltd.

図名 TITLE

潤滑油冷却器

LUB.OIL COOLER

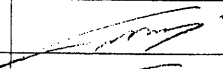
図番 DRAWING NO.

C88804930A

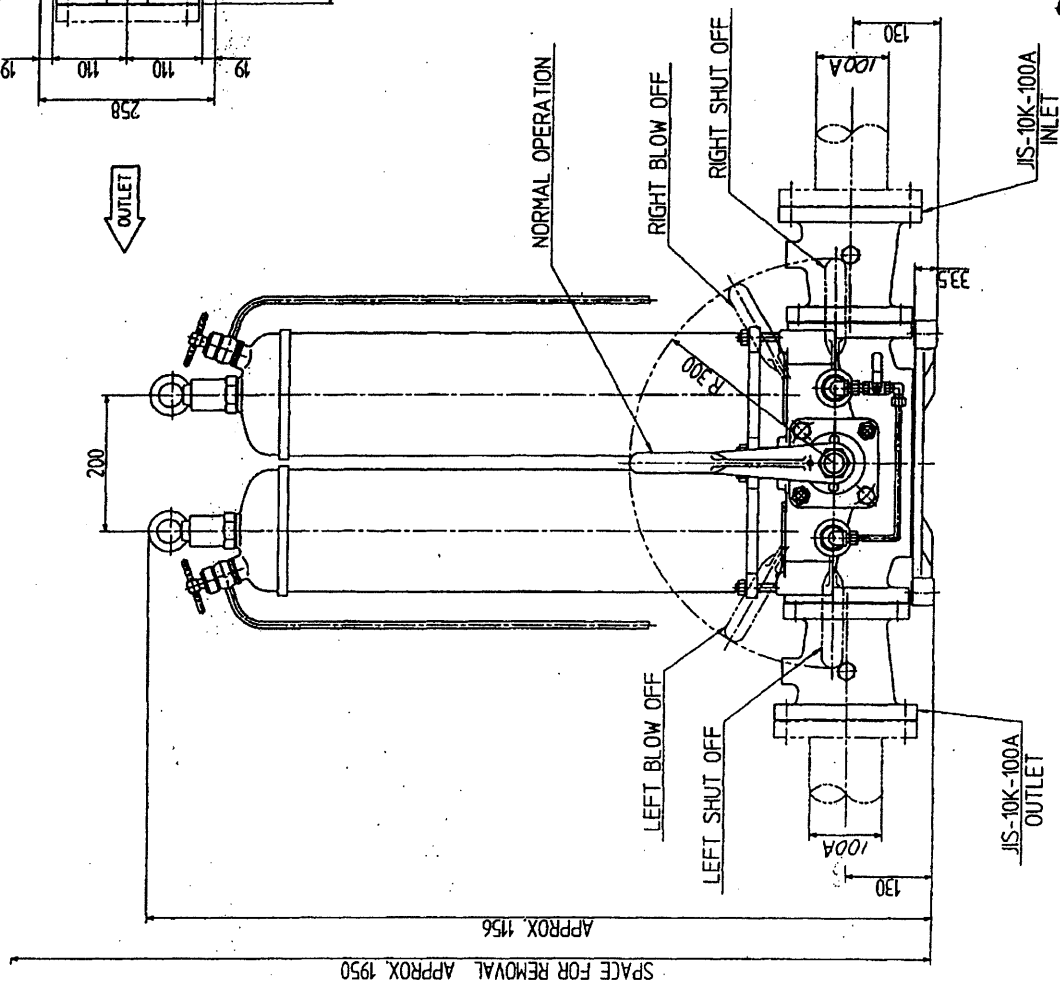
修正 修正確認 図番 DRAWING NO.

**CAD**

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		CLASS. No.			
		SUB. No.			
MODEL	P B - N 3 0 L / 2	DRAWING No.	8 7 9 1 5 1 6 7 A (1/3)		
<p><b>M/E LUB. OIL FILTER</b></p> <p><u>主機潤滑油フィルター</u></p>					
<ul style="list-style-type: none"> <li>• FLOW RATE : Max. 40m<sup>3</sup>/h</li> <li>• FILTER AREA : APPROX. 4878 cm<sup>2</sup>×2</li> <li>• (MESH) : 30 <math>\mu</math> m</li> <li>• CLEANING METHOD : BLOW OFF &amp; CHANGE OVER TYPE</li> <li>• MASS : APPROX. 180kg</li> </ul>					
MARK	REVISION	DRAWN	REVIEWED	APPROVED	DATE
<p>NIIGATA POWER SYSTEMS CO., LTD.</p> <p>ENGINEERING &amp; TECHNOLOGY CENTER</p>			APPROVED		
			REVIEWED		
			DRAWN	T. Higuchi	
			DATE	23 / Apr. / 2002	





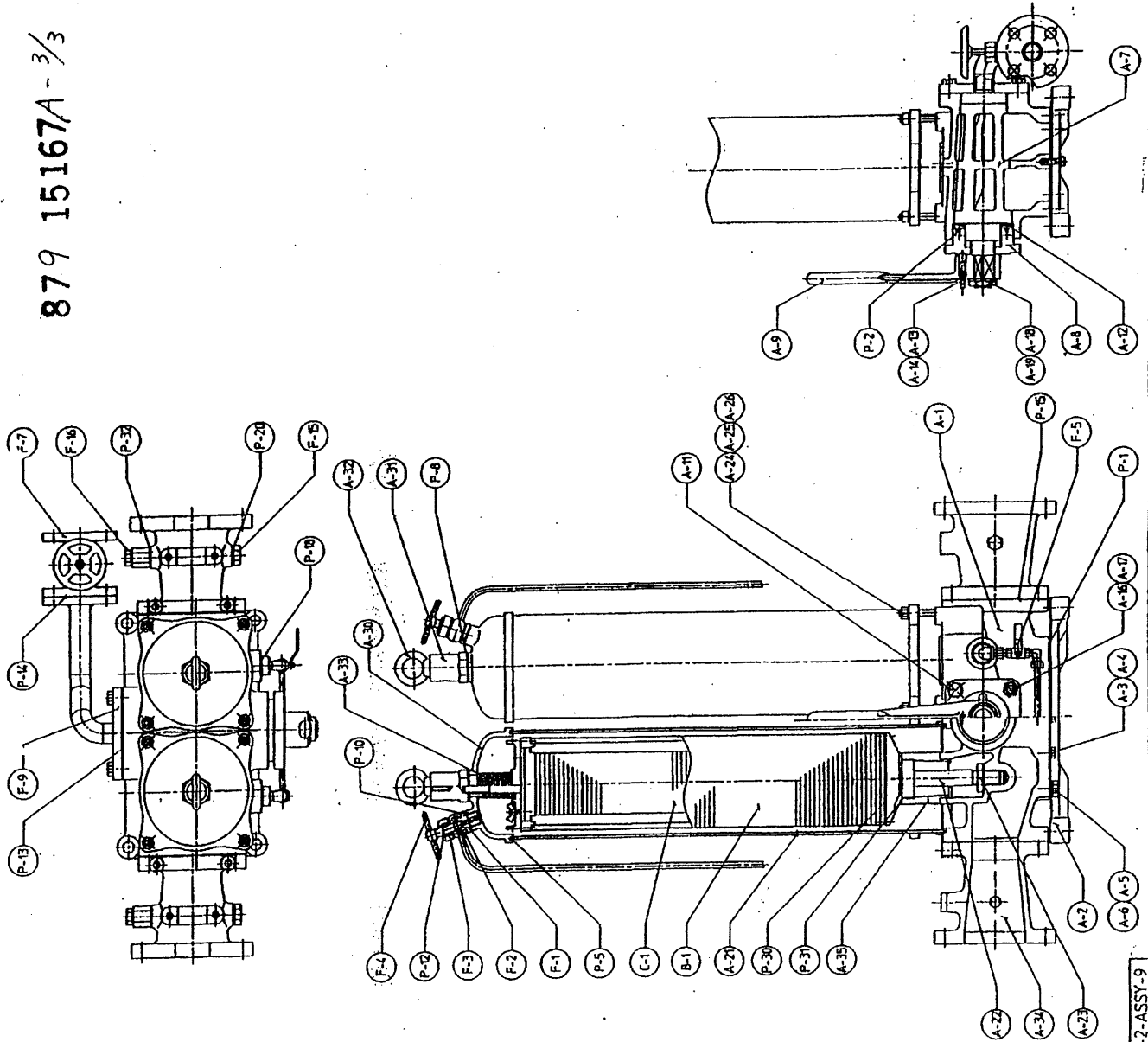
**KANAGAWA KIKI KOGYO CO., LTD.**  
YOKOHAMA JAPAN

879 15167A - 2/3

P8-L-05-9

87915167A (2/3)

879 15167A-3/3



NO.	PARTS NAME	QTY	MATERIAL	REMARKS
A-1	本体	1	FC200	
A-2	底蓋	1	FC200	
A-3	六角ボルト	11	SS400	
A-4	六角ワッシャー	11	SMR57	
A-5	六角ボルト	4	SS400	
A-6	六角ワッシャー	4	SMR57	
A-7	スイッチングロック	1	FC400	
A-8	ロックカバー	1	FC400	
A-9	ハンドル	1	FC400	
A-10	タンクオフボルト	2	SS400	
A-11	パッキングシート	1	SS400	
A-12	パッキング	1	SS400	
A-13	パッキング	1	SS400	
A-14	パッキング	1	SS400	
A-15	パッキング	1	SS400	
A-16	六角ボルト	2	SS400	
A-17	六角ワッシャー	2	SS400	
A-18	六角ボルト	1	SS400	
A-19	六角ワッシャー	1	SS400	
A-20	六角ボルト	2	SS400	
A-21	六角ワッシャー	2	SS400	
A-22	エレメント	2	SS400	
A-23	エレメント	2	SS400	
A-24	六角ボルト	8	SS400	
A-25	六角ワッシャー	8	SS400	
A-26	六角ボルト	8	SS400	
A-27	六角ワッシャー	8	SS400	
A-28	六角ボルト	2	SS400	
A-29	六角ワッシャー	2	SS400	
A-30	六角ボルト	2	SS400	
A-31	六角ワッシャー	2	SS400	
A-32	六角ボルト	2	SS400	
A-33	六角ワッシャー	2	SS400	
A-34	六角ボルト	2	SS400	
A-35	六角ワッシャー	2	SS400	
B-1	エレメント	2	SS400 ALUMINUM	
C-1	エレメント	2	SS400 ALUMINUM	
F-1	弁体	2	SS400	
F-2	接続手	2	SS400	
F-3	接続手	2	SS400	
F-4	接続手	2	SS400	
F-5	接続手	1	SS400	
F-6	接続手	1	SS400	
F-7	接続手	1	SS400	
F-8	接続手	1	SS400	
F-9	接続手	1	SS400	
F-10	接続手	1	SS400	
F-11	接続手	1	SS400	
F-12	接続手	1	SS400	
F-13	接続手	1	SS400	
F-14	接続手	1	SS400	
F-15	接続手	1	SS400	
F-16	接続手	1	SS400	
P-1	パッキング	1	NON ASBESTOS	
P-2	パッキング	1	NON ASBESTOS	
P-3	パッキング	1	NON ASBESTOS	
P-4	パッキング	1	NON ASBESTOS	
P-5	パッキング	1	NON ASBESTOS	
P-6	パッキング	1	NON ASBESTOS	
P-7	パッキング	1	NON ASBESTOS	
P-8	パッキング	1	NON ASBESTOS	
P-9	パッキング	1	NON ASBESTOS	
P-10	パッキング	1	NON ASBESTOS	
P-11	パッキング	1	NON ASBESTOS	
P-12	パッキング	1	NON ASBESTOS	
P-13	パッキング	1	NON ASBESTOS	
P-14	パッキング	1	NON ASBESTOS	
P-15	パッキング	1	NON ASBESTOS	
P-16	パッキング	1	NON ASBESTOS	
P-17	パッキング	1	NON ASBESTOS	
P-18	パッキング	1	NON ASBESTOS	
P-19	パッキング	1	NON ASBESTOS	
P-20	パッキング	1	NON ASBESTOS	
P-21	パッキング	1	NON ASBESTOS	
P-22	パッキング	1	NON ASBESTOS	
P-23	パッキング	1	NON ASBESTOS	
P-24	パッキング	1	NON ASBESTOS	
P-25	パッキング	1	NON ASBESTOS	
P-26	パッキング	1	NON ASBESTOS	
P-27	パッキング	1	NON ASBESTOS	
P-28	パッキング	1	NON ASBESTOS	
P-29	パッキング	1	NON ASBESTOS	
P-30	パッキング	1	NON ASBESTOS	
P-31	パッキング	1	NON ASBESTOS	
P-32	パッキング	1	NON ASBESTOS	

KOL STRAINER

ASSEMBLY DRAWING

KANAGAWA KIKI KOGYO CO., LTD.  
YOKOHAMA JAPAN

87915167A(3/3)

№ 43<sup>4</sup>

1 2 3

記号	来歴	REVISION	年月日	変更	照査	承認			
△	A	CAD化に依り調整スル				△			

注)合フランジ、ガスケット、ボルト、ナット付  
NOTE)WITH FLANGE, GASKET, BOLTS AND NUTS.

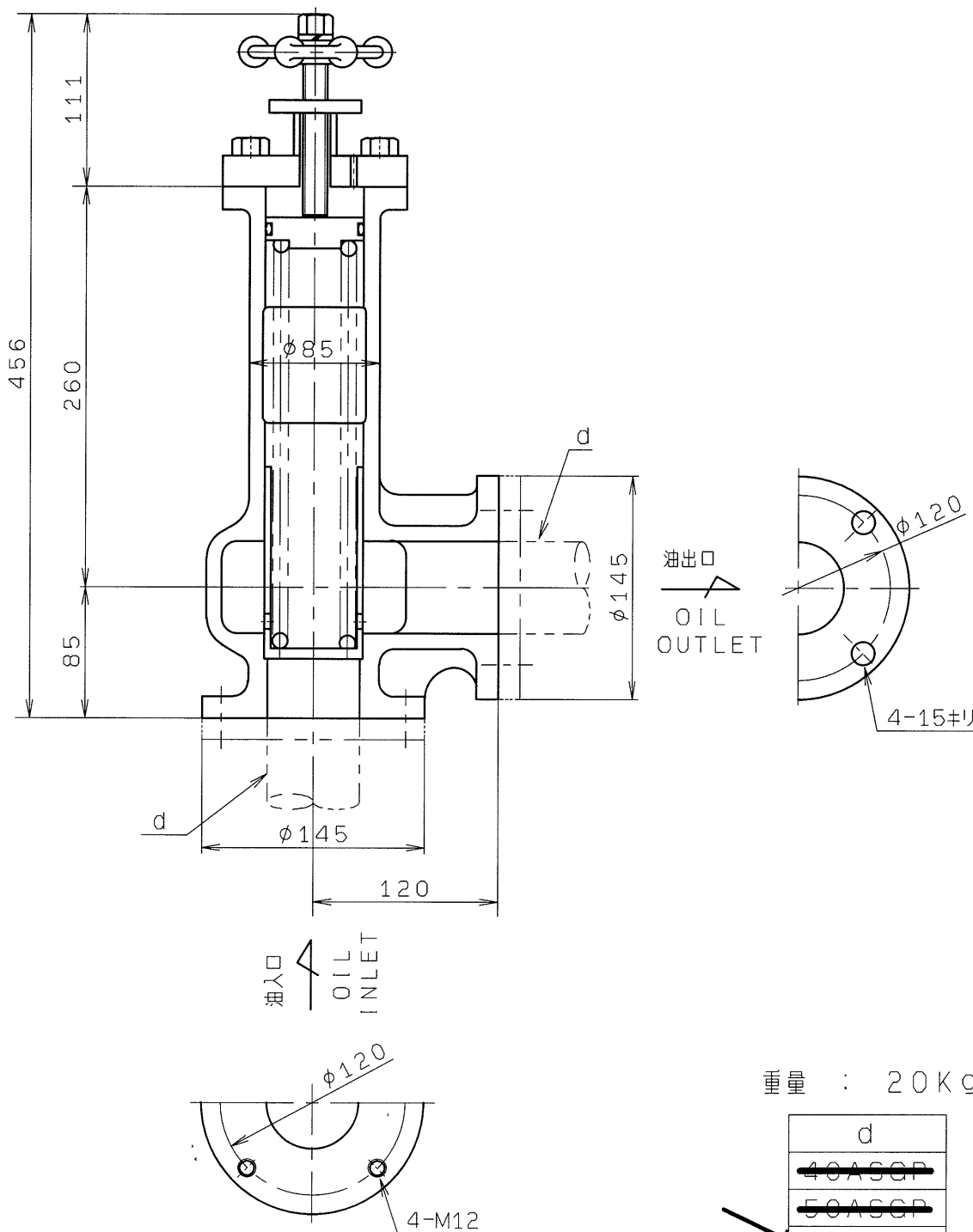
図番 DRAWING NO.

修正確認

修正

CAD

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It must not be reproduced, utilized, communicated or published without express permission.



重量 : 20Kg

d
<del>40ASGP</del>
<del>50ASGP</del>
65ASGP

使用先 ISSUED FOR				図名 TITLE	
摘要 DESCRIPTION/O.N.				潤滑油調圧弁	
10343010H				LUB. OIL PRESSURE REGULATING VALVE	
承認 APPD.	照査 REV.	担当 CHD.	製図 DWN.	年月日 DATE	図番 DRAWING NO.
石黒	石黒	霜村	佐藤	1990-09-14	C3043013A
新潟原動機株式会社 Niigata Power Systems Co., Ltd.					



CLASS No.	_____
SUB. No.	_____

MODEL	DH-100	DRAWING No.	989 00735A
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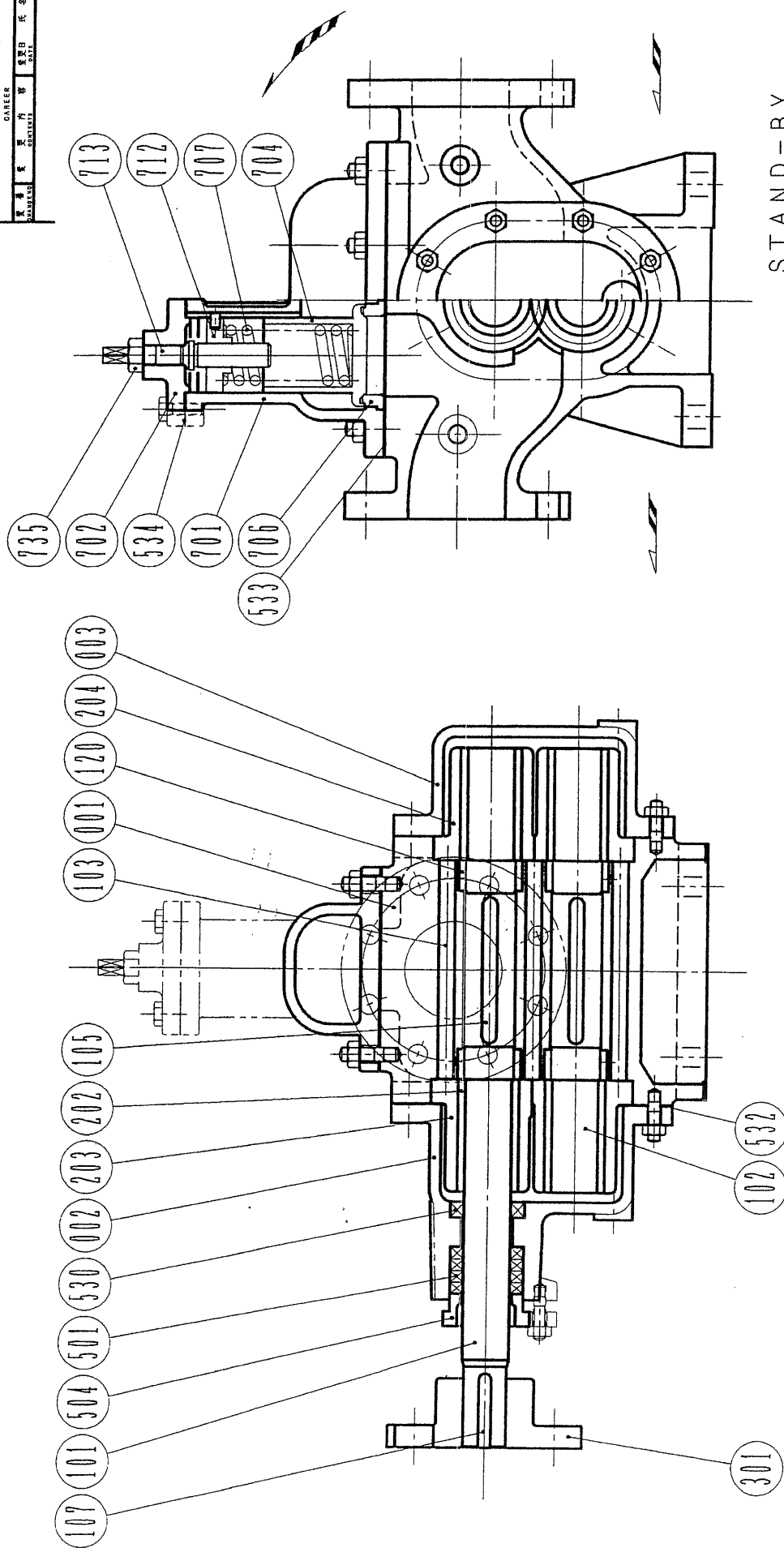
## STAND-BY LUBE. OIL PUMP

### 予備潤滑油ポンプ

CAPACITY : 42m<sup>3</sup>/h × 0.68MPa  
 POWER SOURCE : AC440V, 60Hz, φ3  
 MOTOR OUTPUT : 18.5kW, 6P  
 START METHOD : STAR DELTA STARTING  
 PIPING DIA. : SUC.: 100A, DEL.: 100A  
 CLASS : ABS  
 スペースヒータ付

MARK	REVISION	APPROVED	PASSED	DRAWN	DATE
<b>Niigata Power Systems Co., Ltd.</b> ENGINEERING & TECHNOLOGY CENTER			APPROVED		
			PASSED		
			CHECKED		
			DRAWN	T. Kudou	
			DATE	31-Aug-07	





# STAND-BY OIL PUMP

[illegible]





CLASS No.	_____
SUB. No.	_____

MODEL		DRAWING No.	985 51126A
-------	--	-------------	------------

# STARTER PANEL FOR S/B L.O. PUMP

## 予備潤滑油ポンプ起動器

MOTOR SPECIFICATIC : 18.5kW  
 TYPE : AC440VX60Hz  
 START METHOD : STAR-DELTA  
 CLASS : ABS  
 ATTACHMENT : SPACE HEATER SWITCH

MARK	REVISION	APPROVED	PASSED	DRAWN	DATE
<b>Niigata Power Systems Co., Ltd.</b> ENGINEERING & TECHNOLOGY CENTER			APPROVED	S. Shata	
			PASSED	Y. Oshio	
			CHECKED	Y. Oshio	
			DRAWN	Y. Oshio	
			DATE	10-Sep-07	



MESSRS

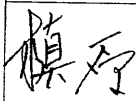
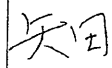
OWNER

SHIPYARD

殿

AC STARTER

S/B L. O. PUMP

CHANGE OR ALTERATIONS		DRAWING & DOCUMENT : ENGLISH			
- -	PREVIOUS DRAWING	JOB No.	K242576	K242578	
2007 - 07 - 20	DRAWING for APPROVAL	CLASS	ABS	ABS	
- -	DRAWING for WORK	TEST No.			
- -	FINAL DRAWING	ORDER No.			
		SHIP No.	JX615	JX616	
		MANUFACTURE No.	13827	13829	
			13828	13830	
		WEIGHT			
		PAINTED COLOR	RAL6019	RAL6019	
		DELIVERY	2007-08-10	2007-09-12	
		APPROVED	CHECKED	DESINE	DRAWN
					
		SANKYO DENKI		DWG No. K242576	

985 51126A

2/7

# 一般仕様書 GENERAL SPECIFICATION

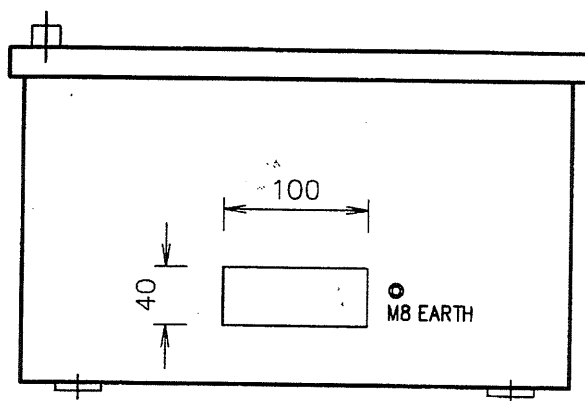
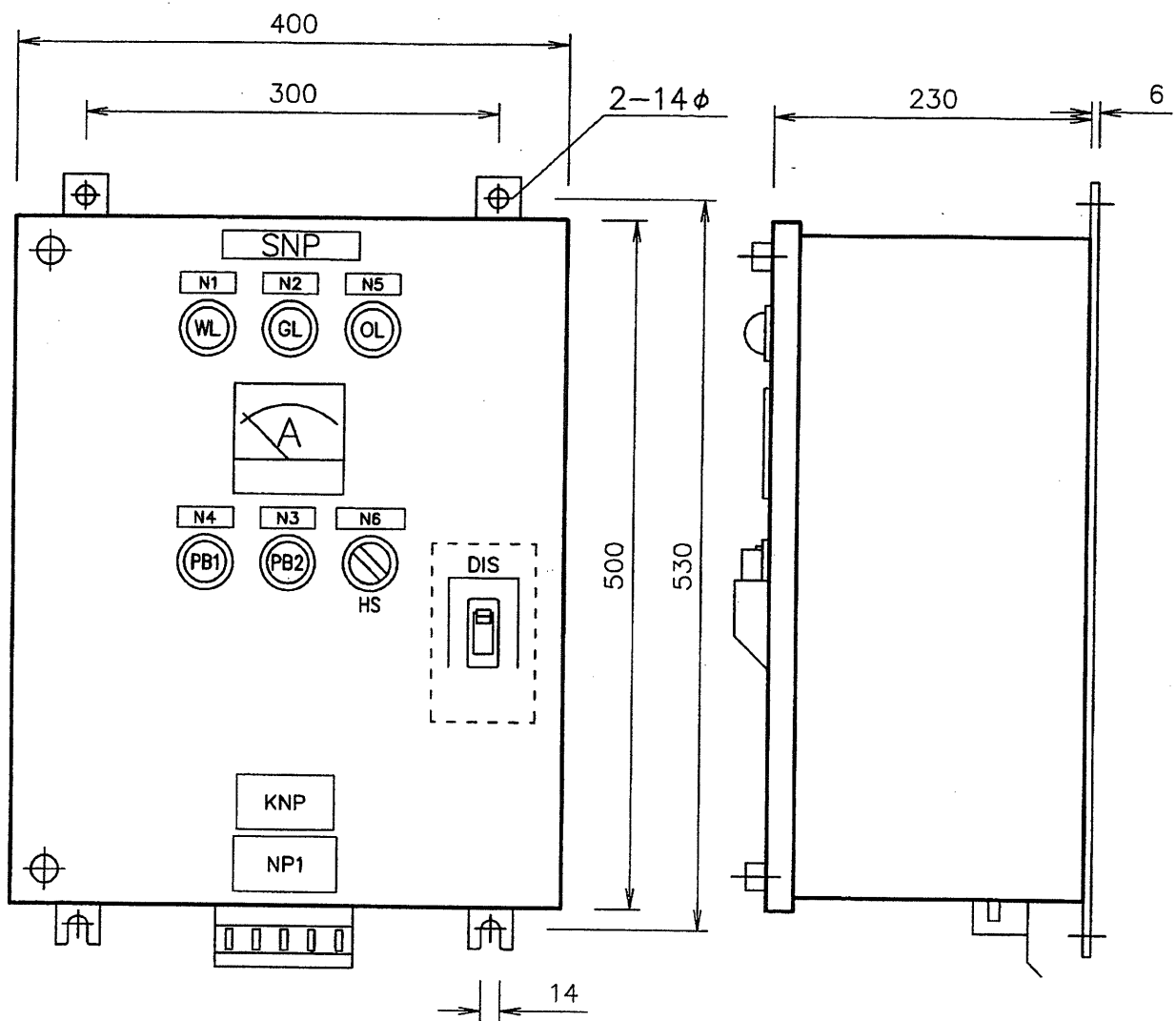
船籍 FLAG OF SHIP				
船級 RULE & REGULATION	■ ABS			
基準 STANDARD	■ JIS                      ■ JEM			
図面 & 図書 DRAWING & DOCUMENT	使用語 LANGUAGE	■ 英語 : ENGLISH	単位 UNIT	■ SI : SI
定格電圧 VOLTAGE RATING	主回路 MAIN CIRC.	■ 440V : 440V	操作回路 CONTROL CIRC.	■ 110V : 110V
周囲温度 AMBIENT TEMPTER	45 °C			
モーター仕様 MOTOR SPECIFICATION	AC 440V    3 φ    60 Hz 18.5 KW    34 A			
塗装色 PAINT COLOR	マンセル記号 MUNSELL No.                      RAL6019			
母線の相配列 BUS BAR PHASE ARRANGEMENT	盤面向かって                      VIEWING FROM PANEL FRONT			
	PHASE (R)	(U)	POLE (P)	LEFT TOP FRONT
	PHASE (S)	(V)		
	PHASE (T)	(W)	POLE (N)	RIGHT BOTTOM REAR
母線の色配列 BUS BAR COLOR IDENTIFY	PHASE (R)	(U) --- ■ RED		
	PHASE (S)	(V) --- ■ WHITE	POLE (P)	
	PHASE (T)	(W) --- ■ BLUE	POLE (N)	
銘板 / 注意銘板 NAME PLATE / CAUTION PLATE	■ 英語 ENGLISH			
盤内配線用電線 CABLE & INTERNAL WIRING		0. 6/1KV SCP	0. 6/1KV SYP	660V UL1015
	POWER CIRCUIT	■		
	CONTROL CIRCUIT			■
断路器 & ヒューズ CIRCUIT BREAKER & FUSE	CIRCUIT BREAKER    SA53CS FUSE                      UC-1			
過電流継電器 OVER CURRENT RELAY	■ 2P			
表示灯 INDICATING LAMP BULB	■ 30 φ    ■ 6.3V    ■ BA9S			
予備品 SPARE PARTS	■ SUPPLIED                      ■ WITH STEEL BOX			
有限会社三協電機 SANKYO DENKI	一般仕様書 GENERAL SPECIFICATION		図番 DWG. No.	K242576-1

985 511251 3/7



		PAGE 3					
記 号 SYMBOL	品 名 DESIGNATION	型式・容量・定格 TYPE・CAPACITY・SPECIFICATION			メーカー MAKER	数量 Q' TY	備 考 REMARK
DIS	DIS-CON SWITCH	SA53CS			FUJI	2	
MCM, MCD	MAGNETIC CONTACTOR	SC-N1	AC110V		FUJI	4	
MCS	MAGNETIC CONTACTOR	SC-5-1	AC110V		FUJI	2	
A	AMMETER	YS-8BR	50/5AX3		mitsubishi	2	
CT	CURR. TRANSFORMER	CW-5L	100/5A		mitsubishi	2	
TLR	TIMER	MS4SY	AC110V		FUJI	2	
OCR	THERMAL RELAY	TR-N3H	24~40A		FUJI	2	
F1, F2, F3	FUSE	UC-1	3A		UTSUNOMIYA	6	
TR	TRANSFORMER	NTP-10	440/110V		HISANO	2	
WL	LAMP	DR30DOL-H4W			FUJI	2	
GL	LAMP	DR30DOL-H4G			FUJI	2	
OL	LAMP	DR30DOL-H4A			FUJI	2	
PB1	PUSH BUTTON	AR30FOR-01R			FUJI	2	
PB2	PUSH BUTTON	AR30FOR-10G			FUJI	2	
HS	SELECT SWITCH	AR30PR-220B			FUJI	2	
TB	TERMINAL BOARD	PT-90	600V 95A	3P	TOGI	2	
TB	TERMINAL BOARD	PTU-80	600V 68A	6P	TOGI	2	
TB	TERMINAL BOARD	PTU-20	600V 19A	6P	TOGI	2	

985 51126A 5/7



有限会社 三協電機  
SANKYO DENKI  
JAPAN ONOMICHI

S/B L.O. PUMP  
OUTLINE VIEW

DRAWING  
No.

K242576-4

PAGE  
4

985 51126A 6/7



CLASS. No.	2 0 5 4 0
SUB. No.	0 0 4 9 9 ( 1/2 )

MODEL		DRAWING No.	
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**RECOMMENDED BRAND TABLE**

**FOR**

**ENGINE LUB. OIL**

SAE40

MARK	REVISION	APPROVED	REVIEWED	DRAWN	DATE
<b>NIIGATA POWER SYSTEMS CO. , LTD.</b>  <b>ENGINEERING &amp; TECHNOLOGY CENTER</b>			APPROVED	T.Shiino	
			REVIEWED	T.Shiino	
			DRAWN	H.FuJikawa	
			DATE	9 / June / 1999	

		<b>RECOMMENDED LUBRICATING OIL</b>	

**Table 1. Medium/Low speed 4 stroke diesel engines(In general land use and marine use) and High speed diesel engines(In marine auxiliary use)  
Viscosity grade : SAE40**

Fuel Oil	Sulfur contents mass %	Bold box shows the recommended range of lubricating oil for each classified fuel.					
Gas Oil	$S \leq 1.0$	[ 50% min. of New Oil TBN and 8 min. of TBN]			Permissible if necessary		
Diesel Oil	$S \leq 1.0$	Ask NIIGATA	[ 50% min. of New Oil TBN and 10 min. of TBN]			Permissible if necessary	
Heavy Fuel	$S \leq 2.0$		[ 50% min. of New Oil TBN and 15 min. of TBN]			Permissible if necessary	
	$2.0 < S \leq 3.5$					[ 50% min. of New Oil TBN and 20 min. of TBN]	
	$3.5 < S \leq 5.0$					[ 25 min. of TBN]	
	Maker / TBN	10	15	20	25	30	40
IDEMITSU		Daphne Marine Oil SX-40(12)		Daphne Marine Oil SW-40(20)	Daphne Marine Oil MV-40(25) *	Daphne Marine Oil SA-40(30) *	
SHELL		GADINIA OIL 40(11)		ARGINA S OIL 40(20) *		ARGINA T OIL 40(30) *	ARGINA X OIL 40(40) *
MOBIL			MOBILGARD 412(15)			MOBILGARD 424(30)	MOBILGARD 442(40)
ESSO		EXXMAR 12TP40(12)			EXXMAR 24TP40(24)	MOBILGARD 430(30)#	MOBILGARD 440(40)#
CALTEX		DELO 1000 Marine 40(12)#				EXXMAR 30TP40(30)	EXXMAR 40TP40(40)
CHEVRON		DELO 1000 Marine 40(12)#				DELO 3000 Marine 40(30)#	DELO 3400 Marine 40(40)#
TEXACO			TARO 16XD40(16)#			DELO 3000 Marins 40(30)#	DELO 3400 Marins 40(40)#
CASTROL		MARINE MLC40(12)		TARO 20DP40(20)#		TARO 30DP40(30)#	TARO 40XL40(40) #
ELF		DISOLA M4010(10)#		220 MXD(22) TLX204(20)#		MXD 304(30)	MXD 404(40)
TOTAL		RUBIA S40(12)	DISOLA M4015(15)	AURELIA 4020(20)#		TLX 304(30)#	TLX 404(40)#
INDIAN OIL		SERVO MARINE C 104(10) SERVO ULTRA 40(10)		RUBIA ST 420(20)		AURELIA 4030(30)	AURELIA XT 40-40(40)
PETRON CORPORATION			PETROMAR 1540(15)	SERVO MARINE C 204(20)		HMA 430(30)	HMA 440(40)
						SERVO MARINE C 304(30)	
				PETROMAR 2040(20)		PETROMAR 3040(30)	PETROMAR 40-40(40)
						PETROMAR TPO 40(30)	

Note: (1) The fuel oil shall be classified into five(5) classes according to the sulfur contents in fuel oil.

- (1) The fuel oil shall be classified into five(5) classes according to the sulfur contents in fuel oil.  
 (2) The figures in [ ] mean the lower limits of total base number(TBN) control condition in service.  
 (3) The figure in ( ) means TBN of lubricating oil.  
 (4) If Pmax is more than approximate 13MPa, the marked "\*" oil have to be used and have to be equivalent to the marked "N" oil.  
 (5) When the marked "N" oil will be used contact with NIIGATA.  
 (6) When lubricating oil other than recommended will be used contact with NIIGATA.

**The herein information and data are confidential and shall not be communicated to the third person.**



記号 来歴 REVISION

年月日

変更 照査 承認

△

A

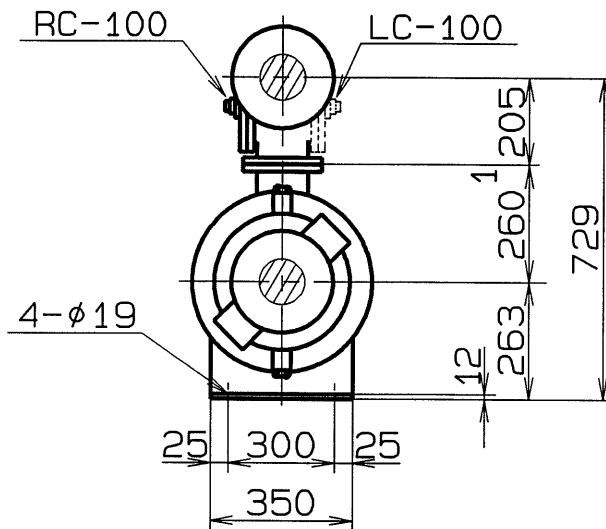
△

注記: 機関一機の場合; RC-100を納入します。

機関二機の場合; RC-100, LC-100を各1組納入します。

NOTE: IN CASE OF ONE ENGINE; SUPPLY LC-100

IN CASE OF TWO ENGINES; SUPPLY RC-100 &amp; LC-100

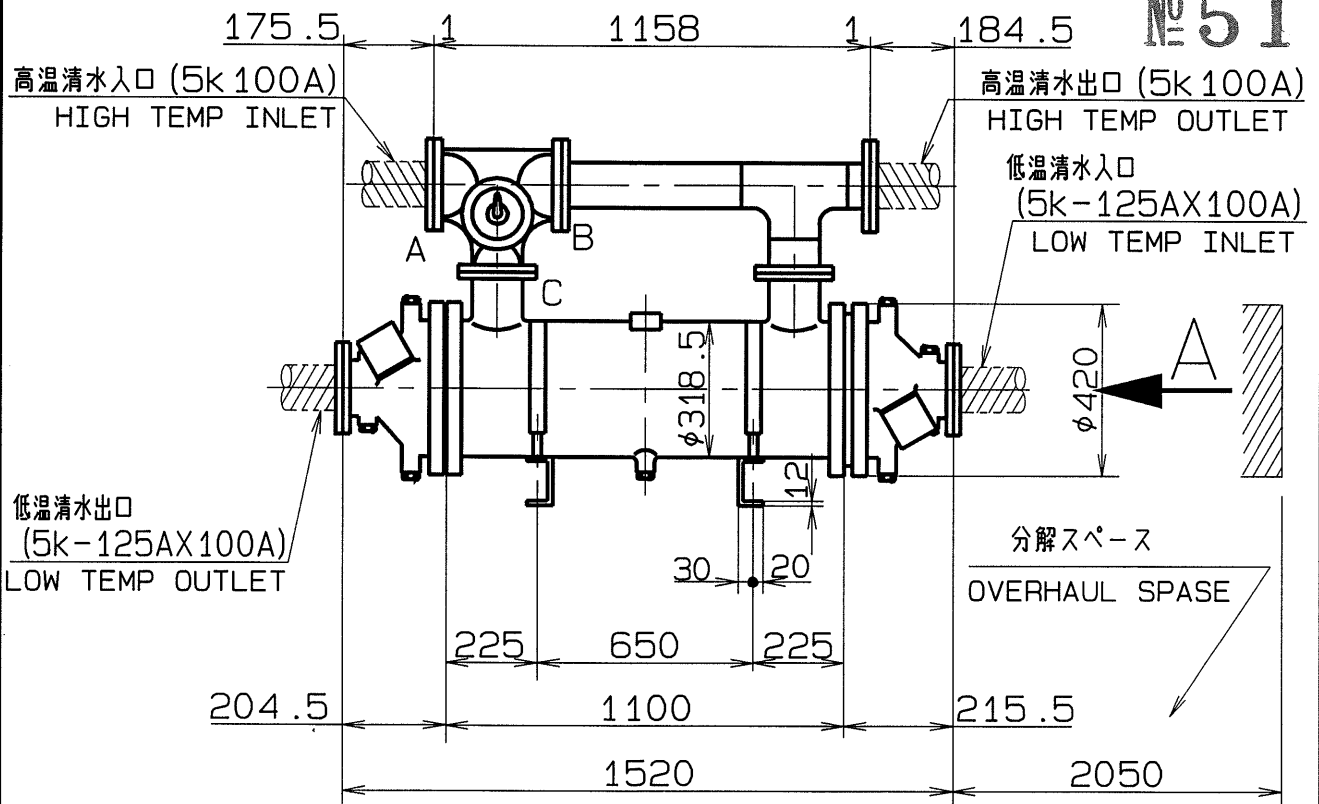


Aカラ見ル

VIEW FROM A

要目  
PARTICULARS

冷却面積 COOLING SURFACE	8	m <sup>2</sup>
冷却管長さ TUBE LENGHT	1133	mm
冷却管数 NO. OF TUBE	203	
冷却管径 × 厚さ TUBE DIA & THICKNESS	φ12×1.2	mm
冷却管材質 MATERIAL OF TUBE	C1220T	
容 量 VOLUME	高温清水 H.T.F.W.	APPROX. 約55L
	低温清水 L.T.F.W.	APPROX. 約40L
質 量 WEIGHT	乾燥 DRY	APPROX. 約347kg
	運転時 FULL	APPROX. 約442kg



使用先 ISSUED FOR

6L28HX



図名 TITLE

摘要 DESCRIPTION/O.N.

YF8-3003

尺度 SCALE  
NOT

承認 APPD.

照査 REV.

担当 CHD.

製図 DWN.

年月日 DATE

YF8

鈴木 大田

鈴木 大田

工 藤

2007.07.25

清水冷却器

FRESH WATER COOLER

図番 DRAWING NO.

C88813842A

新潟原動機株式会社 Niigata Power Systems Co., Ltd.



1

2

3

№ 53<sup>4</sup>

記号 来歴 REVISION

年月日

変更 照査 承認



A CAD化に依り再調整スル。



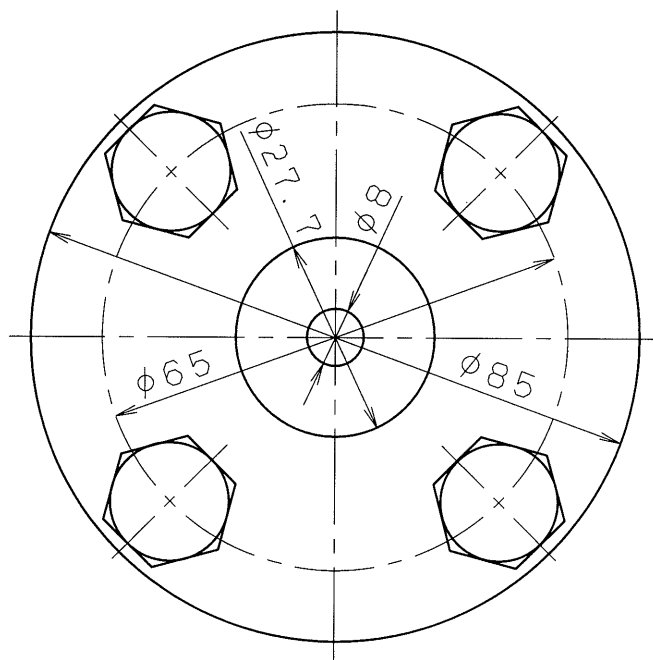
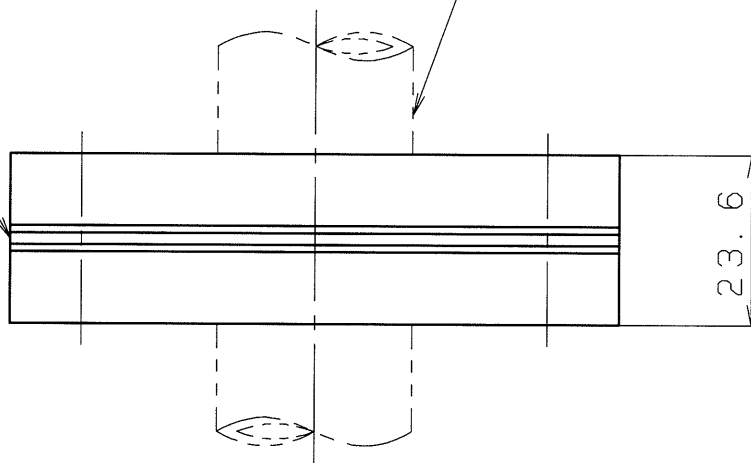
DRAWING NO.

修正確認

修正

CAD

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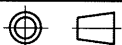
絞り板  $t = 1.6$   
THROTTLE PLATE20A SGP  
3/4 inch

注 記. 造船所ニテ艤装配管上デ清水膨張タンクニ出来ルダケ近く、且ツ垂直配管ノ途中ニ設置願イマス。

NOTE. THIS THROTTLE TO BE FITTED ON THE VERTICAL PIPING  
NEAR THE EXPANSION TANK.

使用先 ISSUED FOR

各 型



図名 TITLE

摘要 DESCRIPTION/O. N.

標準 (94059001A)

尺度 SCALE

1:1

絞り (冷却清水配管空気抜き用)

承認 APPD.

照査 REV.

担当 CHD.

製図 DWN.

年月日 DATE

THROTTLE ASS'Y (AIR VENT FOR F.W. PIPING)

松 浦

宮 本

岩 井

イワイ

1992.01.29

図番 DRAWING NO.

新潟原動機株式会社 Niigata Power Systems Co., Ltd.

C4059001A /



No 54

CLASS No.

SUB. No.

MODEL

SPLC-12R

DRAWING  
No.

888 70051A

M/E JACKET HEATER UNIT主機ジャケットヒータユニットPOWER SOURCE : AC440V, 60Hz,  $\phi$ 3, 12kW

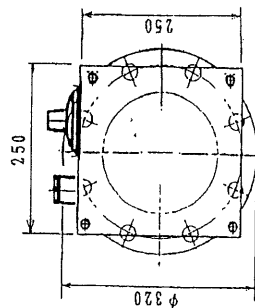
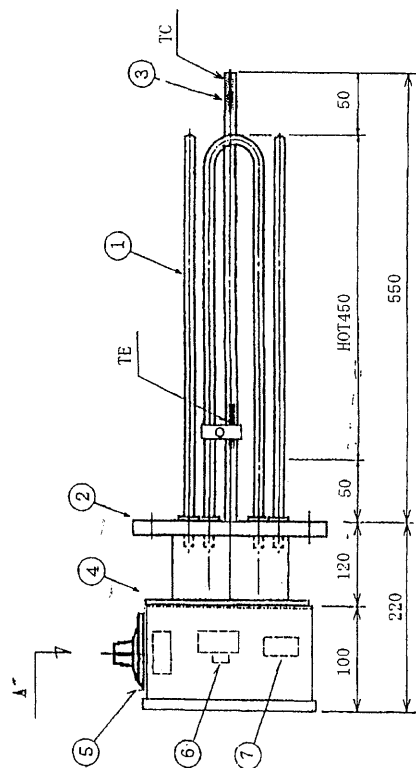
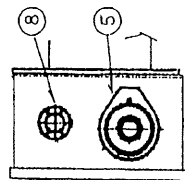
MARK	REVISION	APPROVED	PASSED	DRAWN	DATE
Niigata Power Systems Co., Ltd. ENGINEERING & TECHNOLOGY CENTER			APPROVED	S. Shada	
			PASSED	S. Shada	
			CHECKED	Y. Oshio	
			DRAWN	Y. Oshio	
			DATE	12-Dec-05	

KFRM-2122

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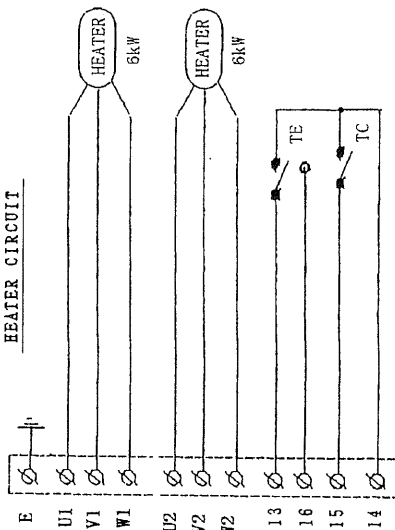
888 70051A -1 / 4





S. NO.	RULE
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## HEATER CIRCUIT



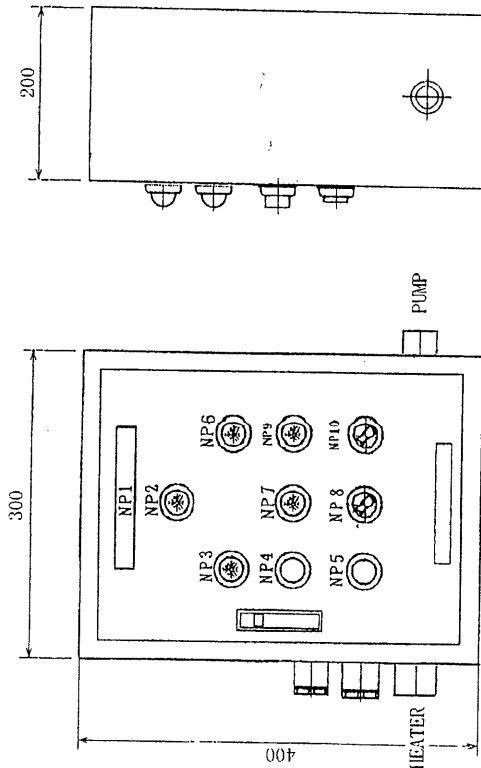
TC -- TEMP. CONTROL THERMOSTAT	0 ~ 40°C	SETTING	°C OFF
TE -- OVERHEAT PROTECTION	9.8 °C	SETTING	OFF

(RETURN-MANUAL OPERATION)

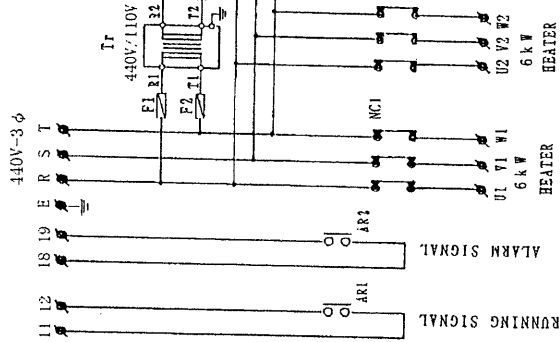
NO.	日	付	記	承認	校	図	設	計	製	図	大栄電熱工業株式会社 DAEI DENNETSU KOGYO CO., LTD	
			事	YAMASHITA	SHIIBA		00TA		IWASA		尺 寸 SCALE	宛 先 ORDER
			NOTE									名 称 TITLE
												JACKET WATER PRE-HEATING UNIT ELECTRIC HEATER SFC-12 440V-3Φ-12kW

888 70051A  $\frac{3}{4}$

FULL VIEW



440V-3φ



CONNECTION DIAGRAM

NAME PLATE

NP 1	HEATER/PUMP STARTER
NP 2	SOURCE (WL)
NP 3	PUMP (GL3)
NP 4	START (PBI)
NP 5	STOP (PB2)
NP 6	ABNORMAL (RL)
NP 7	HEATER (GL1)
NP 8	OFF . 0N (CS1)
NP 9	HEATER (GL2)
NP 10	OFF . 0N (CS2)

TERMINAL

E	R	S	T	U1	V1	W1	U2	V2	W2	U3	V3	W3	11	12	13	14	15	16	
SOURCE				HEATER			HEATER			PUMP			RUNNING			ALARM			TEMP. CONTROL

TEMPERATURE CONTROL

TC	-	TEMP. CONTROL THERMOSTAT	0 ~ 40 °C	SETTING	°C OFF
TE	-	OVERHEAT PROTECTION	9.8 °C	SETTING	OFF
(RETURN-MANUAL OPERATION)					

CONTROL PANEL : WATER PROOF TYPE

COLOR :

N O	SYMBOL	NAME	SPECIFICATION	MAKER
1	MC1-3	MAGNETIC CONTACTOR	3P SC-0	FUJI
2	WL	SOURCE LAMP	APN116-W	IZUMI
3	GL1-3	RUNNING LAMP	APN116-G	D0
4	RL	ALARM LAMP	APN116-R	D0
5	CS 1/2	SELECTOR SWITCH	ASN310	D0
6	TC	TEMP. CONTROL THERMOSTAT	SET 0-40 °C	EGO
7	TE	OVERHEAT PROTECTION	OFF 98 °C	EGO
8	TB	TERMINAL	TU-20X4P TU-15X17P	IZUMI
9	BOX	CONTROL PANEL	RA20-34c	NIITUTO
10	PBI-2	PUSH BUTTON	ABN-110/101	IZUMI
11	ARI-2	AUXILIARY RELAY	MY-2N 110V	FUJI
12	Tr	TRANSFORMER	440V/110V	AIHARA
13		GLAND	25a, 25a, 15c x2	EODEN

日 付 05 12 7		先 宛	
DATE	ORDER		
大 栄 電 熱 工 業 株 式 会 社		名 称	
DAIEI DENNETSU KOGYO CO., LTD		JACKET WATER PRE-HEATING UNIT	
尺 度	A3-5921	TITLE	
SCALE	DRAWING NO	CONTROL PANEL	

888 70051A 4/4

**NIGATA**

CLASS No.	_____
SUB. No.	_____

MODEL	SPLC-12L	DRAWING No.	888 70052A
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**M/E JACKET HEATER UNIT**

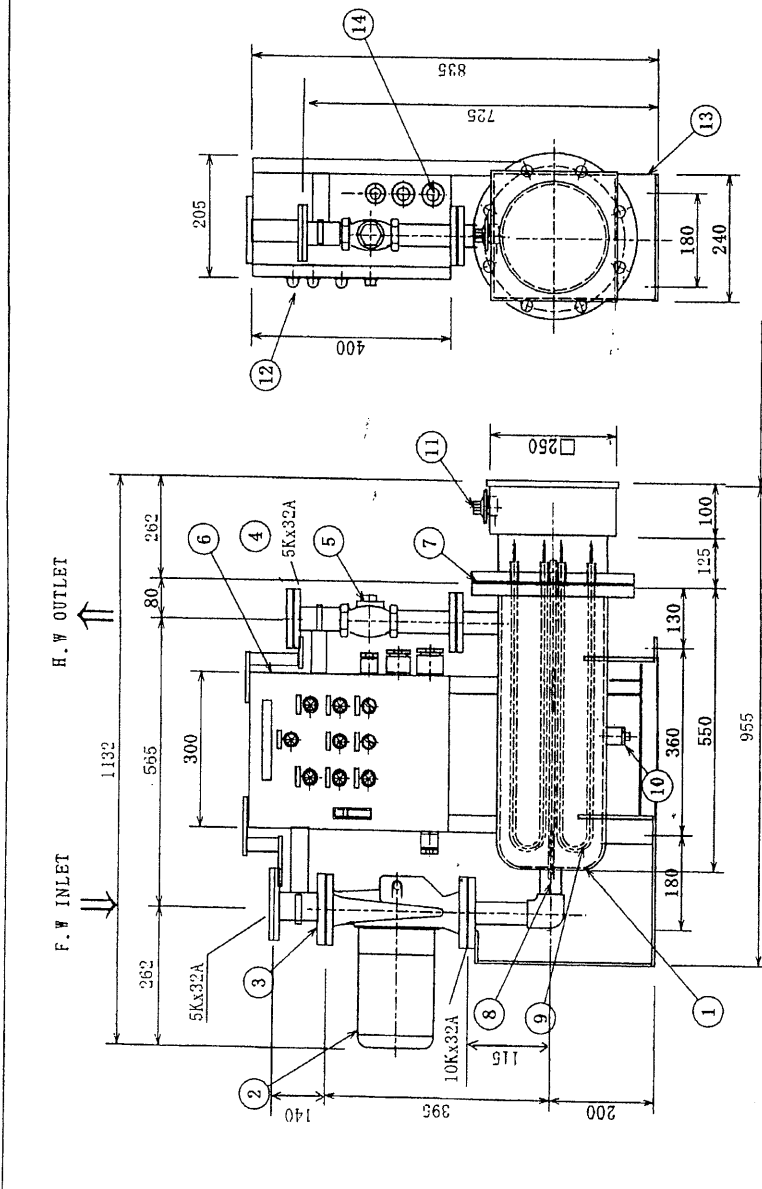
**主機ジャケットヒータユニット**

POWER SOUCE : AC440V, 60Hz,  $\phi$  3, 12kW

MARK	REVISION	APPROVED	PASSED	DRAWN	DATE
<b>Niigata Power Systems Co., Ltd.</b> ENGINEERING & TECHNOLOGY CENTER			APPROVED	[Signature]	
			PASSED	[Signature]	
			CHECKED	Y. Oshio	
			DRAWN	Y. Oshio	
			DATE	12-Dec-05	



品番	品名	材質	個数	備考
NO	PART NAME	MATERIAL	QUANT	REMARKS
1	SHELL	SUS304	1	200A, t4
2	HOT WATER PUMP	BBARA	1	32LPD6.4
3	FLANGE(F.W. INLET)	SUS304	1	JIS5K-32A
4	FLANGE(HOT W. OUTLET)	SUS304	1	JIS5K-32A
5	CHECK VALVE	BC	1	32A
6	CONTROL BOX	SPC	1	t2.3
7	FLANGE(HEATER)	SUS304	1	JIS5K-200A
8	TEMPERATURE SENSOR	SUS304	2	φ10
9	HEATER	SUS316L	6	φ12 x 500
10	SOCKET(DRAIN)	SUS304	1	1/2B
11	TEMPERATURE CONTROLLER	EGO	2	23. 26A
12	LAMP	IZUMI	5	APN-146W, G.R
13	INSTALLATION LEG	SS400	2	t 6.0
14	GLAND	BsB	4	25ax2 15cx2



SPECIFICATION

S.NO. \_\_\_\_\_ RULE \_\_\_\_\_

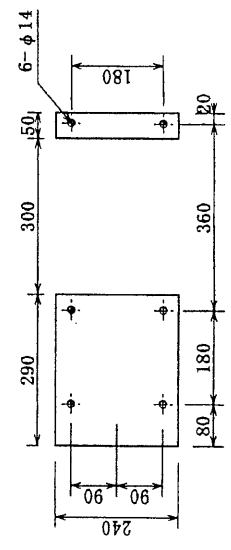
\* J.W. PREHEATING UNIT  
1. MODEL : SPLC-12 (L)  
ELECTRIC HEATER : SFC-12 440V-3φ-12kW ( 6kW + 6kW )  
2. PUMP : TYPE-32LPD6.4  
CAPACITY : 440V-3φ-0.4kW FREQUENCY : 60 Hz  
FLANGE(F.W. INLET/OUTLET) : JIS5K-32A  
TANK CAPACITY : 19 ℓ  
MATERIAL(PART IN WATER) : SUS304  
COLOR \_\_\_\_\_  
WEIGHT : 85 kg  
Q'ty : 1 SET/1 SHIP

SPECIFICATION

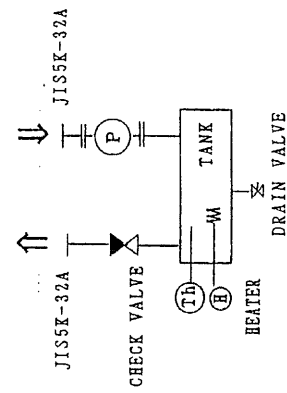
NAME	BORE	POWER	DISCHARGE	NET PUMP HEAD	ALLOWABLE BOOST PRESSURE
32LPD6.4	mm	kW	ℓ/min	m	MPa
	32	0.4	40	16	0.5 MPa

FREQUENCY : 60 Hz  
RATED VALUE : 440V-3φ-0.4kW

ATTACHING DETAIL DRAWING



PIPING DIAGRAM



TEMPERATURE CONTROL :

23 - TEMP. CONTROL THERMOSTAT  
0 ~ 40 °C SETTING °C  
26A - OVERHEAT PROTECTION  
98 °C SETTING OFF

INSPEC.

INSULATION RESISTANCE 10 MΩ  
HIGH VOLTAGE 2000 V/min  
HYDRAULIC TEST PRESSURE 0.98 MPa

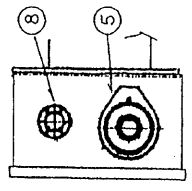
承 認 校 図 設 計 製 図	大 栄 電 熱 工 業 株 式 会 社	日 付 05 12 7	名 称	J.W. PREHEATING UNIT
APPROV'D BY	DAI-1 DENNETSU KOGYO CO., LTD	DATE	ORDER	440V-3φ-12kW
記 事	MINAKI	尺 寸	図 面	FULL VIEW
NO.	DATE	SCALE	A3-5918	

888 70052A 2/4

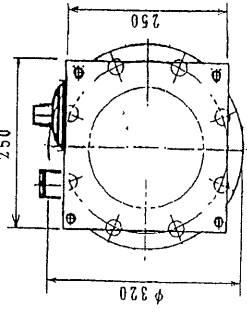
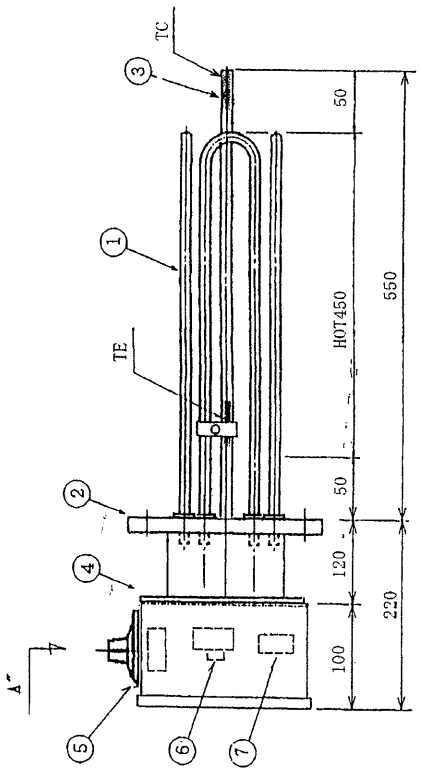
NO	DESCRIPTION	MATERIAL	REMARKS
1	HEATING ELEMENT	SUS316L	6 $\phi$ 12 x500L
2	FLANGE	SUS304	1 JIS5K-200A
3	SENSOR ENCLOSING TUBE	SUS304	1 $\phi$ 12
4	TERMINAL BOX	SPC	1 12.3
5	TEMP. CONTROL THERMOSTAT	EGO	1 0~40℃
6	OVERHEAT PROTECTION	EGO	1 98℃
7	TERMINAL	FUJI	1 6P.4P.E
8	GRAND	B&B	1 25a

INSPECTION

HYDRAULIC TEST PRESSURE	0.98 MPa
INSULATION RESISTANCE	10 MΩ OVER
HIGH VOLTAGE	2000 V/min



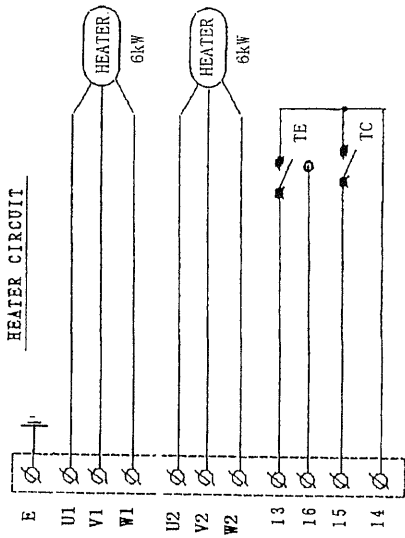
A-SEC.



SPECIFICATION

S.NO.	RULE
HEATING DEVICE	JACKET WATER PRE-HEATING UNIT
MODEL	SFC-12
VOLTAGE	440V
PHASE	3 $\phi$
CAPACITY	12kW (6kW+6kW)
ELEMENT	2.0kW X 6
FLANGE	JIS5K-200A
GLAND	25a
COLOR	
WEIGHT	22 kg
Q'TY	1 SET./SHIP

HEATER CIRCUIT



TEMPERATURE CONTROL

TC - TEMP. CONTROL THERMOSTAT	0~40℃	SETTING	℃ OFF
TE - OVERHEAT PROTECTION	98℃	SETTING	OFF

(RETURN-MANUAL OPERATION)

NO.	DATE	付 記 NOTE	承認 APPROV BY YAMASHITA	檢 査 CHECKED BY SHIIBA	設 計 DESIGN BY OOTA	圖 形 DRAWN BY IWASA	大栄電熱工業株式会社 DAIEI DENNETSU KOGYO CO., LTD		先 行 DATA 05 12 7	尺 度 SCALE	圖 面 DRAWING NO A3-5920	名 称 JACKET WATER PRE-HEATING UNIT
												TITLE ELECTRIC HEATER SFC-12 440V-3 $\phi$ -12kW

888 70052A 3/4



		CLASS. No.		2 0 5 4 0	
		SUB. No.		0 5 4 E ( 1/5 )	
TYPE		DRAWING No.			
<p><b>INSTRUCTIONS FOR USE OF</b></p> <p><b>COOLING WATER TREATING AGENT FOR</b></p> <p><b>FRESH WATER COOLED DIESEL ENGINES</b></p>					
E	清水添加剤使用基準（340001）改正による。	遠藤	—	国府田	1994 / 10 / 07
MARK	REVISION	APPROVED	REVIEWED	DRAWN	DATE
<p><b>NIIGATA POWER SYSTEMS CO. , LTD.</b></p> <p><b>ENGINEERING &amp; TECHNOLOGY CENTER</b></p>			APPROVED		T. Ishiguro
			REVIEWED		—
			DRAWN		A. Kunifuda
			DATE		29 <sup>th</sup> / Nov. / 1990

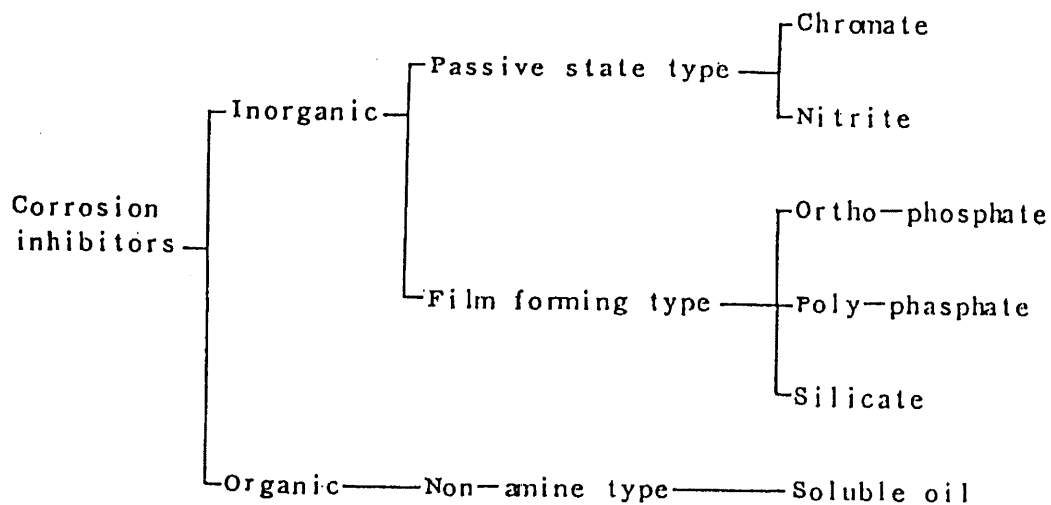
## §1. Purpose of use

The cylinder liner jackets of diesel engines that are cooled with fresh water are said to become corroded generally by cavitation or electrochemical corrosion.

Such corrosion can be prevented by adding a corrosion inhibitor into the cooling water to form a durable, stable protective film over the metal surfaces.

This brochure gives a working standard on the proper use of corrosion inhibitors, which are important for protecting fresh water cooled diesel engines, to provide reliable protection of the fresh cooling water circulation lines from corrosion.

## §2. Major components of corrosion inhibitors



### 1) Chronate

Little used today because chromate corrosion inhibitors are toxic and pose waste water problems.

### 2) Nitrite

Much used today because nitrite corrosion inhibitors are nontoxic and pose no waste water problem. But care must be taken when discharging waste water because it is subject to government regulations.

### 3) Silicate

Silicate corrosion inhibitors are completely free of toxicity and waste water can be discharged without treating.

## 4) Soluble oil

Soluble oil corrosion inhibitors are made by adding a surface active agent, etc. into mineral oil. waste oil to be discharged must meet the \*C. O. D. requirements and the oil content must be treated.

## ✕ C. O. D. (Chemical Oxygen Demand)

If a reducing agent (in this case, waste water containing a corrosion inhibitor) is added into fresh water (or sea water), the oxygen in the water will be reduced, making the water deficient of oxygen. The amount of oxygen required to make up for the deficiency of oxygen is expressed in C. O. D. (\_\_\_) P. P. M.

The following methods may be used to meet the C. O. D. requirements.

- a) Dilute oxygen-deficient water with an appropriate amount of water.
- b) Blow air into oxygen-deficient water.
- c) Add an oxidizing agent (sodium hypochlorite or the like) into oxygen-deficient water to oxidize it.

## §3. Caution in using corrosion inhibitors

Methods of adding corrosion inhibitors, concentration, disposal of waste water, etc. vary somewhat with manufacturers.

When using a corrosion inhibitor, observe the following instructions and consult with the manufacturer.

## 1) Adding

Generally, prepare a thick solution of 10 to 20 % in volume and gradually pour it into the cooling water. In case an antifreeze liquid must be added into the cooling water in cold regions, seek advice from the corrosion inhibitor manufacture because the mixture could adversely affect both the antifreeze and the corrosion inhibitor.

2) Concentration control

If the solution prepared is too thick or thin as compared with the required concentration, it could accelerate corrosion. Be sure to conform to the concentration control standard of the corrosion inhibitor manufacturer.

Use a concentration control instrument available from the manufacturer.

3) Waste water disposal

Disposal of waste water is subject to the C. O. D. regulations (See section 2) or to other regulations imposed by central and local governments, which may differ from one country to another. Study such regulations and seek advice from the corrosion inhibitor manufacturer when disposing of waste water.

§ 4. Brands of fresh water additives. 2 0 5 4 0 - 0 5 4 E ( 5 / 5 )

Product name	Supplier	Component	Amount to be added	Disposal of waste water	Supplier's telephone number
HIMOL AM-5	TAIHO INDUSTRIES LTD.	Nitrite	0.25 Vol. %	Oxidize by suitable method and discharge.	TOKYO 03-3445-8113
HIMOL L-10	TAIHO INDUSTRIES LTD.	Ditto	1.0 Vol. %	Ditto	TOKYO 03-3445-8113
KOHRUYU MS-2	KOHRUYU INDUSTRIAL CO., LTD.	Ditto	0.35 Vol. %	Ditto	OSAKA 06- 532-2561
ORGAFILM C-3	JAPAN ORGANO CO., LTD.	Ditto	0.2 ~0.3 Vol. %	Ditto	TOKYO 03-3689-5136
POLICRIN I-175	KURITA WATER INDUSTRIES LTD.	Ditto	0.8 Vol. %	Ditto	TOKYO 03-3347-3366
KURILEX L-109	KURITA WATER INDUSTRIES LTD.	Ditto	1.2 Vol. %	Ditto	TOKYO 03-3347-3433
NEOS PN-106	NEOS CO., LTD.	Ditto	0.2 ~0.3 Vol. %	Dilute by suitable method and discharge.	KOBE 078-331-9381
SHADAN K	OTSUKA CHEMICAL CO., LTD.	Hydrazine	2.0 Vol. %	Ditto	TOKYO 03-3294-1391
NISSEKI BLUECOOL S	NIPPON OIL CO., LTD.	Carboxylic acid Phosphate	5.0 Vol. %	Ditto	TOKYO 03-3502-9166
EDOLAS #25	EDOLAS CO., LTD.	Silicate	0.1 ~0.2 Vol. %	No special treatment is necessary. Discharge as it is.	TOKYO 03-3583-8575
DISTILLAN-RR	YAMAMIZU CO., LTD.	Phosphate	0.04 ~0.05 Vol. %	Ditto	TOKYO 03-5640-4742

Note : Figures in the "Amount to be added" column show concentration percentage to the total volume of cooling water.



CLASS. No.	2 0 5 4 0
SUB. No.	2 9 3 ( 1/4 )

MODEL		DRAWING No.	
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**INSTRUCTIONS FOR**

**AIR VENT PIPING IN THE FRESH WATER EXPANSION TANK**

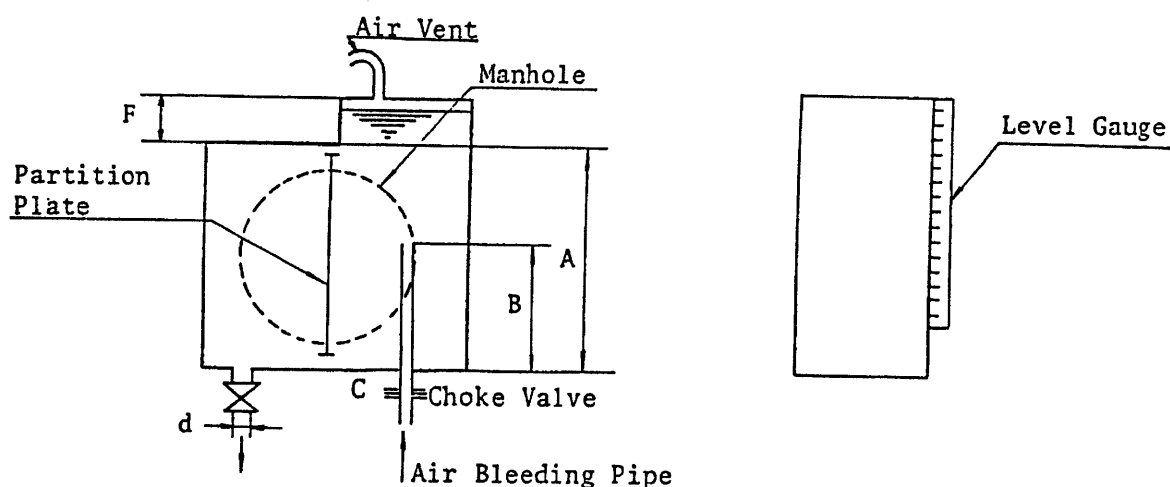
MARK	REVISION	APPROVED	REVIEWED	DRAWN	DATE
<b>NIIGATA POWER SYSTEMS CO. , LTD.</b>  <b>ENGINEERING &amp; TECHNOLOGY CENTER</b>			APPROVED	M. Kawakita	
			REVIEWED	T. Shimomura	
			DRAWN	S. Iwai	
			DATE	15 <sup>th</sup> / Oct. / 1985	

AIR VENT PIPING IN THE FRESH WATER EXPANSION TANK		20540
		293 2/4

Cavitation which is counted among the causes of corrosion of the cooling section of the fresh water-cooled engine is very much ascribable to the mixing of air in the cooling water and the evolution of air bubbles. It is recommended that the instructions given in this manual be observed when installing the cooling water system so as to prevent the mixing of air and evolution of air bubbles.

## 1. Expansion Tank

### (1) Under Normal Conditions

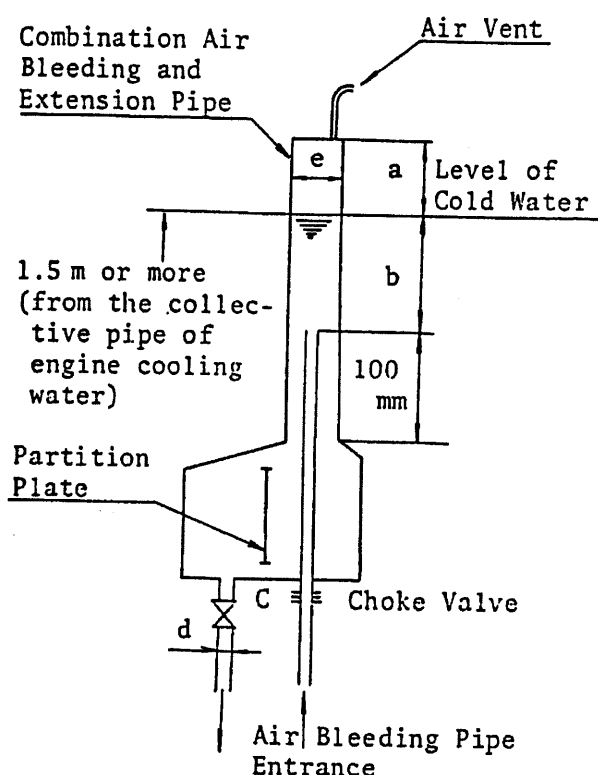


- The expansion tank has an air bleeding pipe that opens under it, as illustrated above. The height of the air bleeding pipe (B) should be about two-thirds of the height of the tank. The expansion tank should be provided with a manhole, a cock for an outlet pipe, and a level gauge. The level gauge should be as near the top of the air pocket as possible.
- The capacity of the expansion tank should be determined at a rate of  $0.14 \frac{\text{lit.}}{\text{PS}} \frac{\text{per (PS)}}{\text{kW}}$  of the engine, usually 200 lit. The cross-sectional area of the air pocket should be  $1000 \text{ cm}^2$  or less and its height should be decided so that water may not overflow even when the volume of water expands by 10 lit. For instance, the height (F) of the air pocket should be about 15 cm, when its cross-sectional area is  $1000 \text{ cm}^2$ .

AIR VENT PIPING IN THE FRESH WATER EXPANSION TANK		20540
		293 <span style="float: right;">3/4</span>

- (c) The expansion tank should be installed at such a height that the level of tank water is 1.5 m or more from the highest position of the engine cooling water (position of the collective pipe of engine cooling water).

(2) When the expansion tank is too low



- (a) Install an extension pipe as shown on the left.
- (b) Bring the level of tank water to the greatest possible height from the highest position of the engine cooling water (position of the collective pipe of engine cooling water)
- (c) The relationships between extension pipe diameters (e) and distances (b) to the level of cold water are as follows:

e (mm)	b (mm)	a (mm)
67 (GP 65 A)	About 1400	About 3000
80 (GP 80 A)	About 1000	About 2200
100 (GP 100 A)	About 650	About 1300
150 (GP 150 A)	About 300	About 600

- (d) The distance between the top of the air vent and the level of cold water must be greater than (a) to allow for the expansion by about 10 lit. of water resulting from a temperature rise.

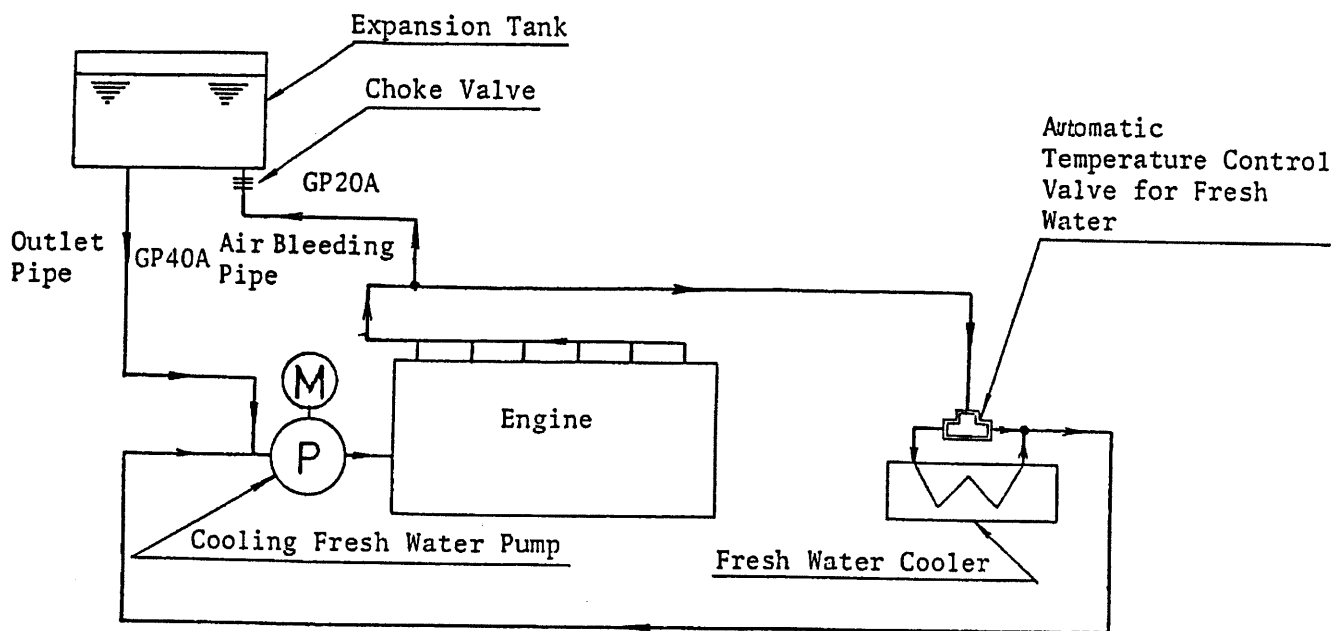
## 2. Water Outlet Pipe Diameter and Choke Valve Size

Water outlet pipe (d) GP40A or larger

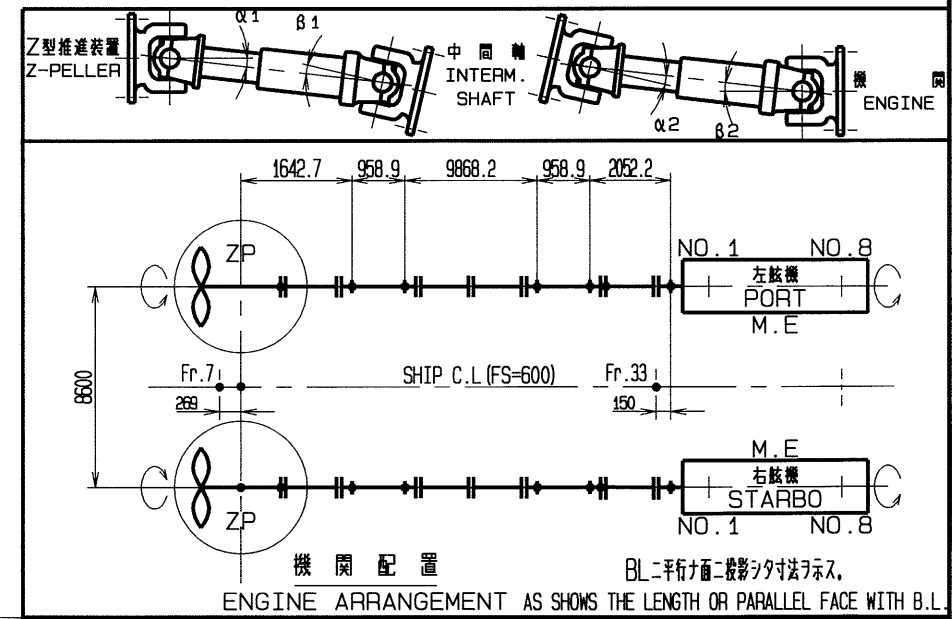
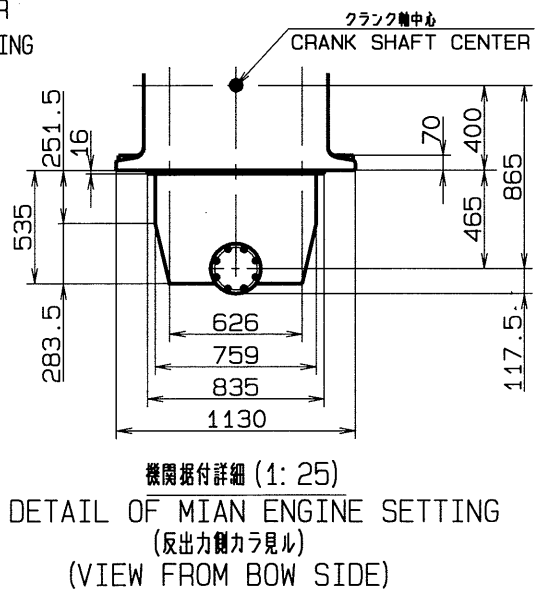
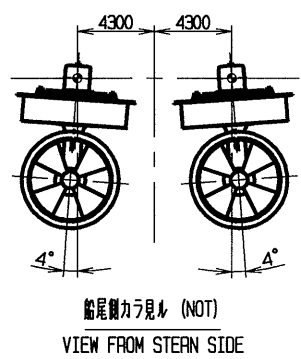
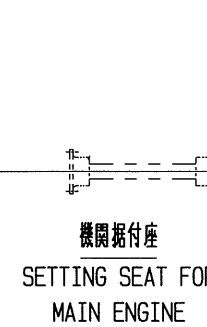
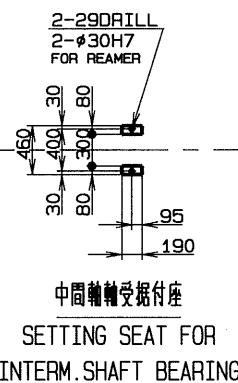
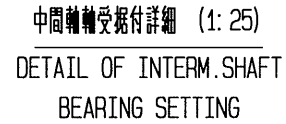
Choke valve (c) 8 mm (It should be installed near the tank inlet.)






AIR VENT PIPING IN THE FRESH WATER EXPANSION TANK	20540
	293 4/4

### 3. Care in Cooling Water Piping




- Install the air outlet on top of the collective pipe of engine cooling water and fit an air bleeding pipe.
- The fresh water cooler should be in a lower position than the engine where possible. (When it cannot be installed in that position, also run an air bleeding pipe from the fresh water cooler to the expansion tank.)
- Provide an air separator on the air bleeding pipe near the end of the collective pipe of engine cooling water.
- The water outlet pipe should be located as near the pump inlet as possible.
- Choke valve will be supplied by Niigata.
- It is recommended that use be also made of a corrosion inhibitor (refer to the Instruction Manual 20540-054E for information on the Corrosion Inhibitor) so as to obtain adequate protection of the cooling section of your engine against corrosion.



1. 本図ハ左舷機ヲ示ス。  
THIS DRAWING SHOWS THE PORT UNIT.
2. U. Jノ入力軸, スプライン軸, 出力軸ハ同一平面トスル。  
THE FLANGE YOKES, THE STUB YOKE AND THE SPLINE YOKE OF UNIVERSAL JOINT SHALL BE ON A SAME PLANE.
3. 各々ノ、ユニバーサルジョイント角度ハ、 $\alpha 1 = \beta 1$ ,  $\alpha 2 = \beta 2$ トシ、 $\alpha 1$ ,  $\beta 1$ ,  $\alpha 2$ ,  $\beta 2$ ハ共 $\pm 6.5$ 度以内ニシテ、カツ角度差ハ $0.5$ 度(最大:  $1^\circ$ )以内トシテサシ。  
THE TILTING ANGLES OF UNIVERSAL JOINT,  $\alpha 1$ ,  $\beta 1$  AND  $\alpha 2$ ,  $\beta 2$  SHALL BE WITHIN  $6.5$  DEG.  
THE TOLERANCE OF EACH ANGLE IS  $\pm 0.5$  DEG. (MAX.  $1$  DEG.).  
THE FOLLOWING RELATIONS SHALL BE MAINTAINED  $\alpha 1 = \beta 1$ ,  $\alpha 2 = \beta 2$ .
4. ユニバーサルジョイントノ取り付け方法ニ関シテハ、フランジヨークガ船首、船尾側トモ一致スルコト  
本図ニ示ス通り取り付け願イハス。  
THE PHASES OF BOTH UNIVERSAL JOINTS ON THE BOW AND STERN SIDES SHALL BE SAME AS SHOWN IN THE ABOVE DROWING.
5. ZP据付台ノ据付面ノ平行度ハ $\pm 0.5$ mm程度ニ願イハス。  
THE Z-PELLER INSTALLATION PLANE SHULD BE SMOOTHLY MACHINED AFTER WELDING WITH FLATNESS OF  $\pm 0.5$ mm.
6. 排気圧排ハ $2.5$ kPa以下トシテサシ。  
THE BACK PRESSURE OF EXHAUST GAS SHOULD BE BE WITHIN  $2.5$ kPa AT THE TURBO CHARGER OUTLET.
7. 中間軸受ヘハ、クラッチヨリ艀繋配管ニテ注油願イハス。(造船所手配)  
THE LUBRICATING OIL PIPING FOR INTERMEDIATE SHAFT BEARINGS SHALL BE CONNECTED WITH THE CLUTCH BY SHIPYARD.
- |   |  |
|---|--|
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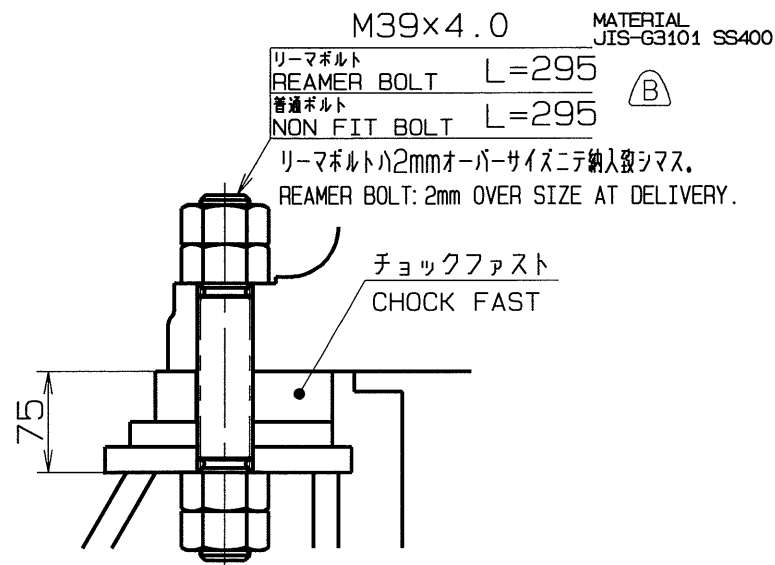
[illegible]

使用年 ISSUED FOR 8.29.84 BE72 ZP-410P		 図名 TITLE 軸系寸法決定図 SHAFTING EQUIPMENT	
描等 DESCRIPTION/0.N.		尺度 SCALE 1:50	
承認 APPO.	照査 REV.	担当 CHD.	製図 OWN.
高橋 絵畑		大塩 工藤	
新潟原動機株式会社 Niigata Power Systems Co., Ltd.		2007.06.13	
図番 DRAWING NO.		75M01204B 1/2	

この図面は新機軸（株）が所有するものである。許可なく複製、利用、貸与、公衆に示すこと、  
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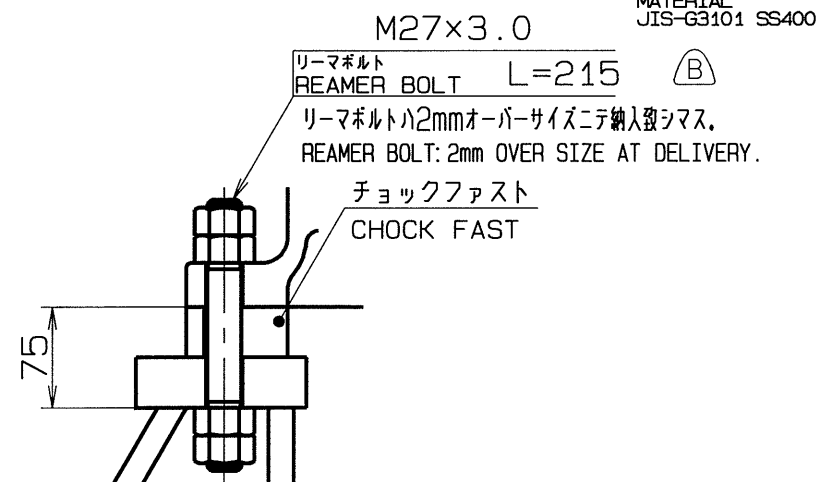
CAD

修正 図番 修正確認 図番



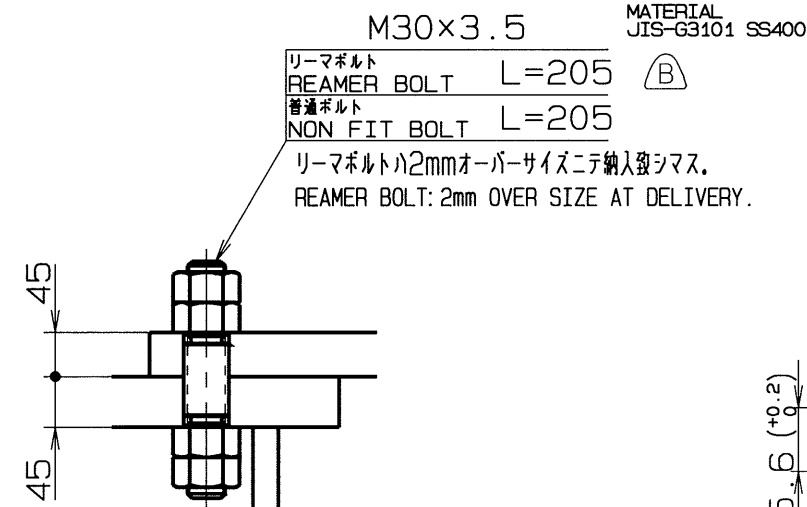
機関据付ボルト

SETTING BOLT FOR  
MAIN ENGINE



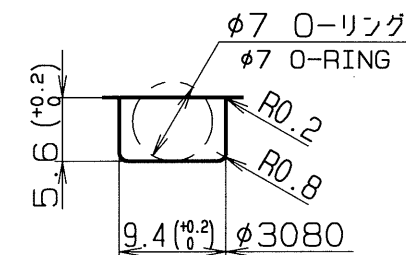
中間軸軸受据付ボルト

SETTING BOLT FOR  
INTERM.SHAFT BEARING



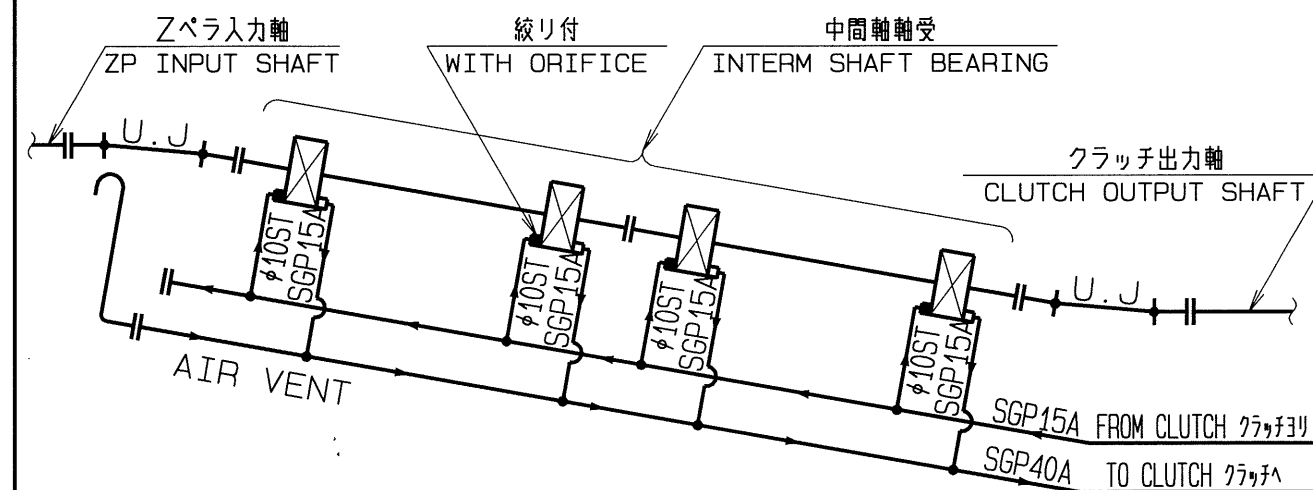
Z型推進装置据付ボルト

SETTING BOLT FOR  
Z-TYPE PROPULSION UNIT



X部O-リング溝詳細 (造船所所掌) 参考 (1.5: 1)

DETAIL X OF O-RING GROOVE  
(SHIPYARD ARRANGEMENT)



中間軸軸受潤滑油管系統図  
L.O. PIPING DIAGRAM OF  
INTERM. SHAFT BEARING

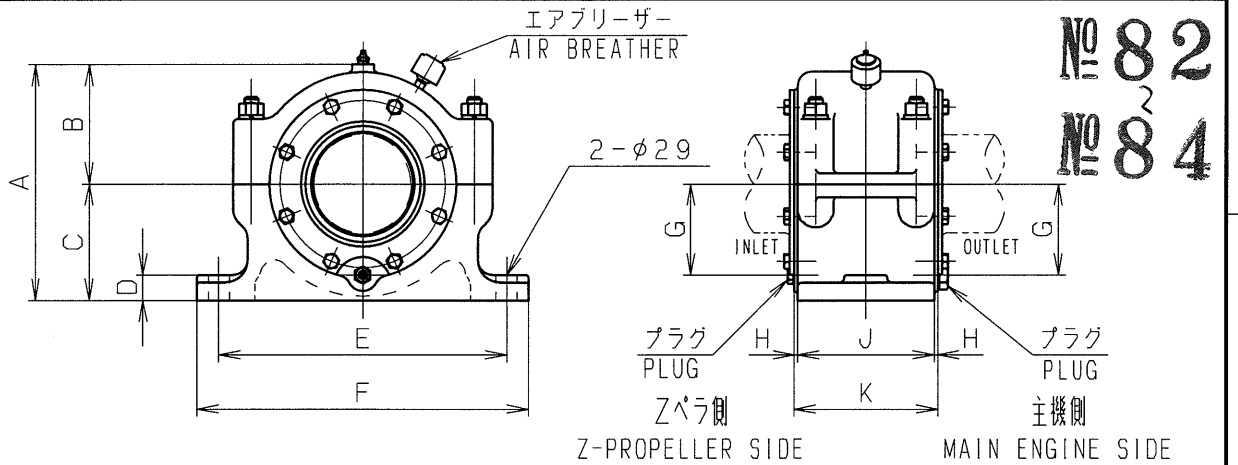
記号	来歴	REVISION	年月日	変更	照査	承認

使用先 ISSUED FOR 8L28HX, HLP-85Y, ZP-41	図名 TITLE 軸系寸法決定図 SHAFTING EQUIPMENT
摘要 DESCRIPTION/O.N.	尺度 SCALE 1:6
承認 APPD.	照査 REV.
担当 CHD.	製図 DWN.
年月日 DATE	

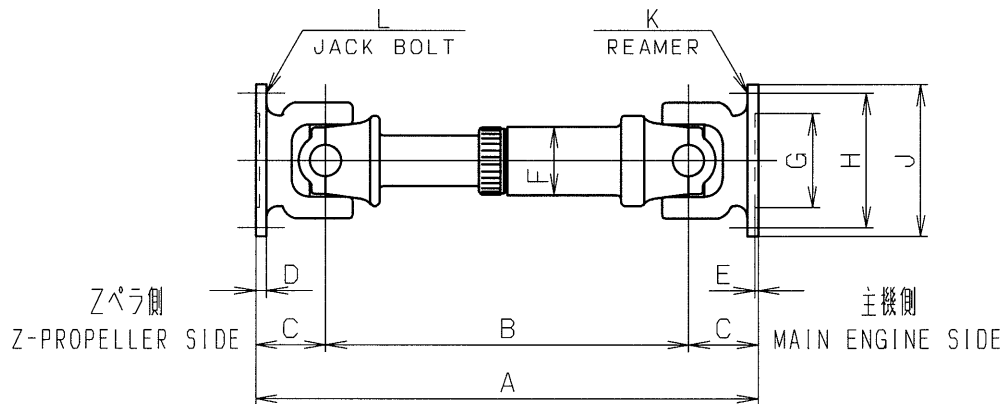
新潟原動機株式会社 Niigata Power Systems Co., Ltd.

図番 DRAWING NO.  
75M01204B 2/2


記号	来歴 REVISION	年月日	変更	照査	承認	△	UJ4136-97型追加。	2007.08.31	次細	■	絵畑	高橋
Ⓐ	エアブリーザー位置変更	2006.01.17	時任	絵畑	高橋	△						



軸受 BEARING	A	B	C	D	E	F	G	H	J	K	質量 MASS (Kg)
φ130用	292	142	150	35	370	430	115	16	148	180	58
	ラジアル軸受 (RADIAL)					スラスト軸受 (THRUST)					79560092A
軸受 BEARING	A	B	C	D	E	F	G	H	J	K	質量 MASS (Kg)
φ140用	325	165	160	35	400	460	125	5	190	200	83
	ラジアル軸受 (RADIAL)					スラスト軸受 (THRUST)					79562090A



89230081A	1355	965±15	195	32	7	φ273	φ250H7	φ370	φ420	16-φ24.1 <sup>+0.2</sup> <sub>0</sub>	—
	MAKER DRAWING No. : 4136-97-01/03x1285-0.8										
89230077A	1160	820±15	170	25	8 <sup>+0.5</sup> <sub>0</sub>	φ219	φ220H7	φ310	φ350	14-φ22.1 <sup>+0.2</sup> <sub>0</sub>	2-M22x2.5
	MAKER DRAWING No. : 4156-95-00/03x11-n										
89230073A	1060	760±15	150	25	8 <sup>+0.5</sup> <sub>0</sub>	φ218	φ220H7	φ310	φ350	10-φ22.1 <sup>+0.2</sup> <sub>0</sub>	2-M22x2.5
	MAKER DRAWING No. : 4156-90-31/03x11-n										
89230072A	950	600±15	135	20	7 <sup>+0.5</sup> <sub>0</sub>	φ162	φ175H7	φ245	φ285	8-φ20.1 <sup>+0.2</sup> <sub>0</sub>	2-M20x2.5
	MAKER DRAWING No. : 4106-84-00/03x11-n										
	A	B	C	D	E	F	G	H	J	K	L

使用先 ISSUED FOR						図名 TITLE	
摘要 DESCRIPTION/O. N. 新GEWES, 中間軸受グリース式				尺度 SCALE NOT		軸受・ユニバーサルジョイント	
承認 APPD.		照査 REV.	担当 CHD.	製図 DWN.	年月日 DATE	BEARING・UNIVERSAL JOINT	
絵 畑		絵 畑	大 塩	久保田 (略)	2005.02.10	図番 DRAWING NO.	
新潟原動機株式会社 Niigata Power Systems Co., Ltd.						C9560079C /	

修正 図番 DRAWING NO.

CAD

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CLASS No.	20540
SUB No.	00697-1/2

MODEL	95 and 97 type	WORK No.	
<h1>HOW TO ADJUST FOR LENGTH OF GEWES AT INSTALLATION</h1>			
<b>Niigata Power Systems Co., Ltd.</b>  ENGINEERING & TECHNOLOGY CENTER		APPROVED	S.Ehata
		CHECKED	S.Ehata
		PREPARED	T.Tokitou M.Hasegawa
		DATE	June.01.2006



How to adjust for length of GEWES at installation

1. Check your cardan shaft length “L” or “L1” before installation.

Is it suitable that the installation length as follows the table?

Type	L (mm)	L1 (mm)
95	1160	820
97	1355	965

2. Please adjust the length of the cardan shaft as follows.

2.1. Please remove the pressure valve.

2.2. Please extend as follows about “L1” length.

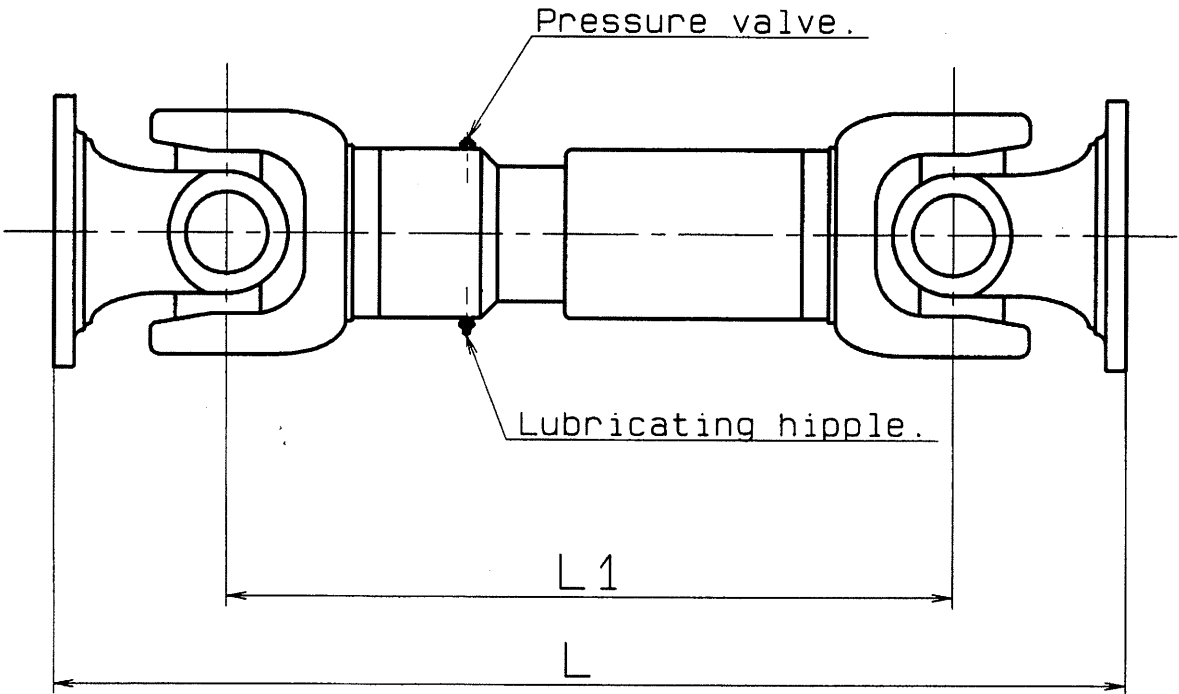
Type	Before (Min.)	After
95	765	820
97	895	965

Note) Before length is minimum length.

2.3. Please fit the pressure valve.

3. Tolerance of length

Type	L1 (mm)
95	820 ±15
97	965 ±15



№ 86<sup>4</sup>

1

2

3



記号 来歴 REVISION

年月日 変更 照査 承認



DRAWING NO.

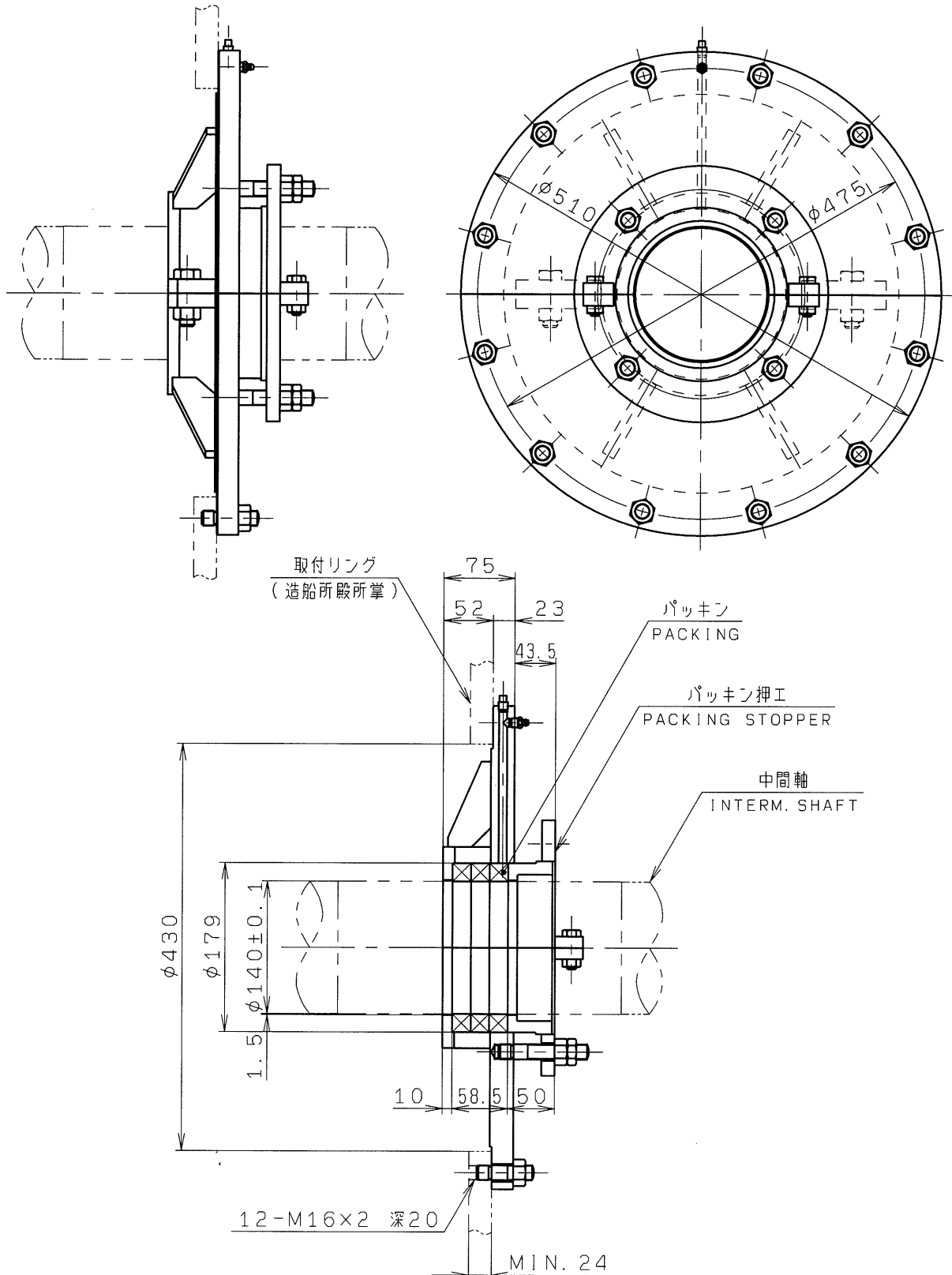
図番

修正確認

修正

CAD

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使用先 ISSUED FOR

摘要 DESCRIPTION/O. N.  
中間軸 φ140用

承認 APPD.

照査 REV.

担当 CHD.

製図 DWN.

年月日 DATE

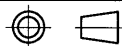
椎 野

椎 野

藤 川

長谷川

1996. 07. 15



尺度 SCALE  
1:6

図名 TITLE

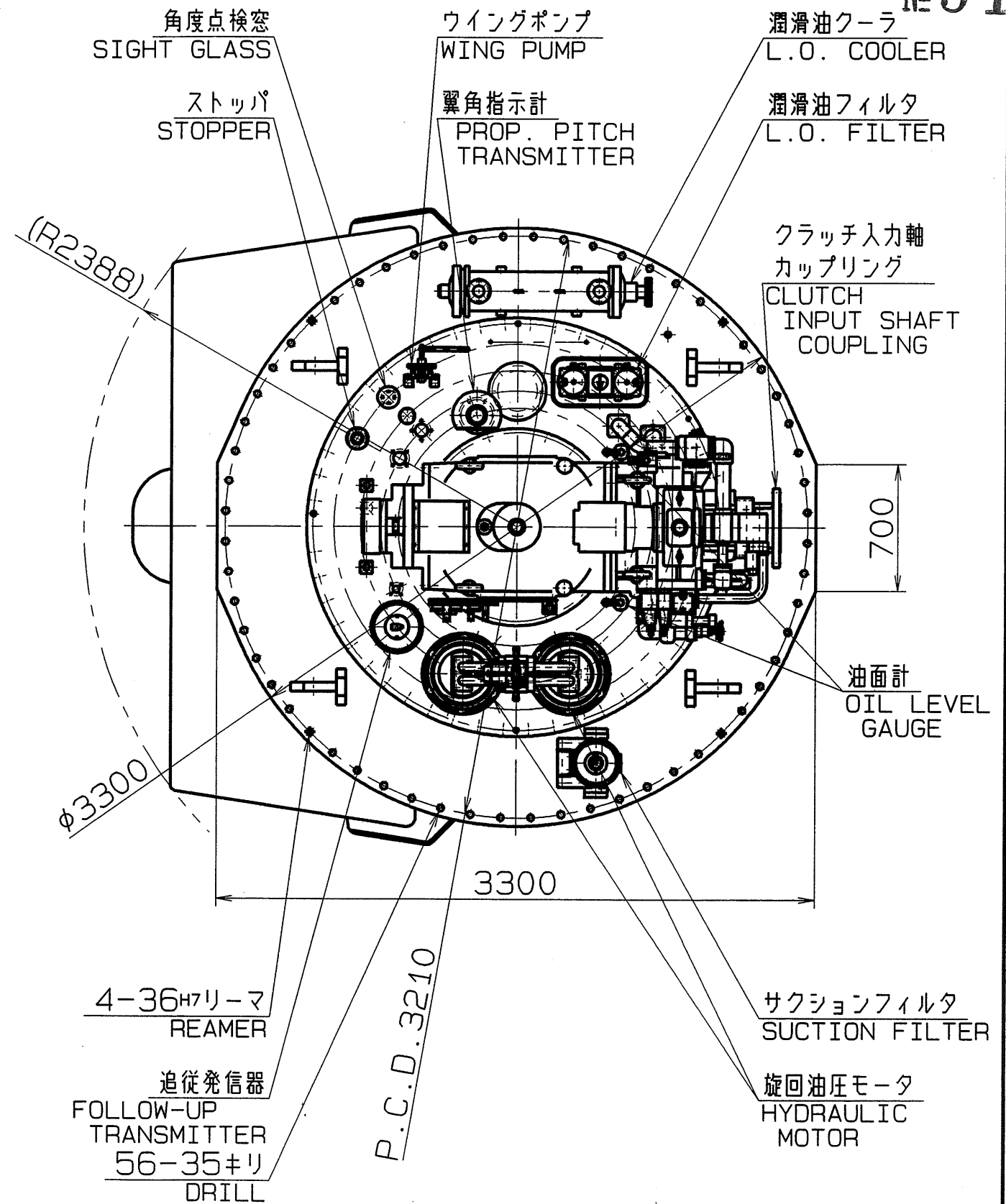
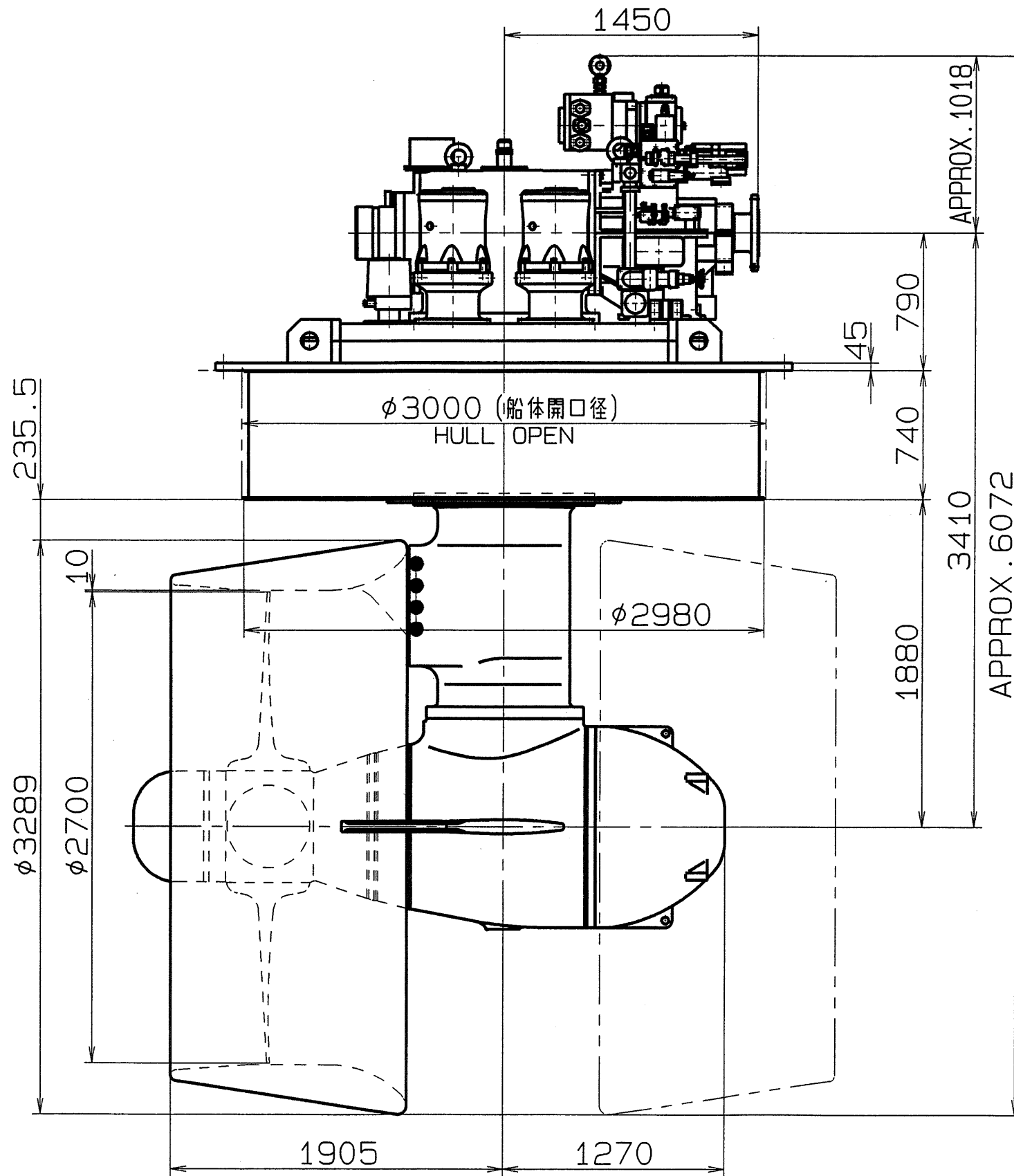
隔壁パッキン箱

STUFFING BOX

図番 DRAWING NO.

新潟原動機株式会社 Niigata Power Systems Co., Ltd.

C79540022C 1/1



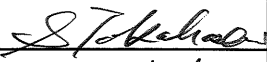

記号	来歴	REVISION	年月日	変更	照査	承認
△						
△						
△						
△						
△						

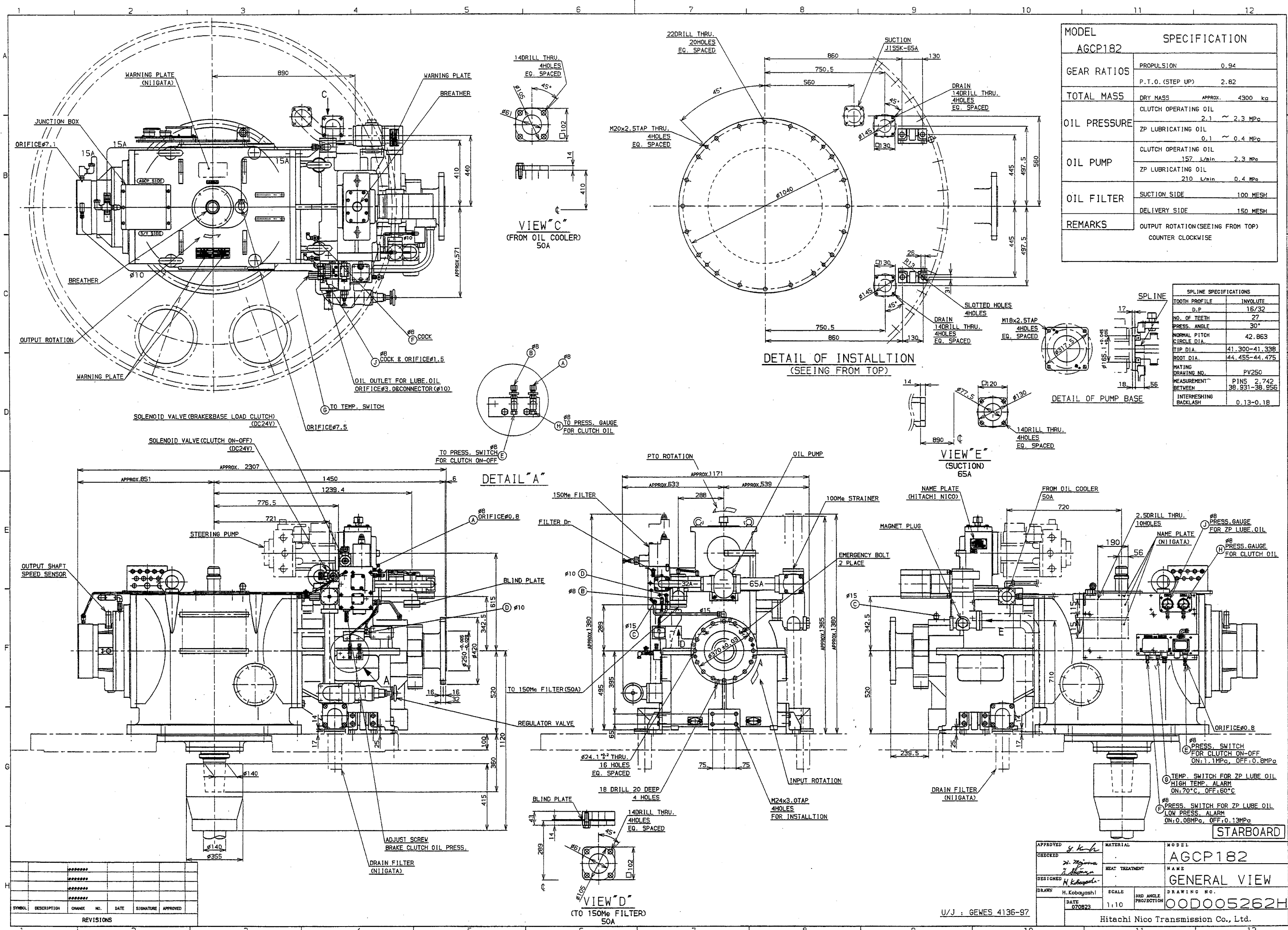
使用先 ISSUED FOR	ZP-41CP
摘要 DESCRIPTION/OWN	クマタ内蔵型 ベラD1A2700: 台座3300FLAT: 大径クマ
承認 APPD.	南 南家
照査 REV.	今田
担当 CHD.	佐々木
製図 DWN.	2007.10.12
年月日 DATE	
新潟原動機株式会社 Niigata Power Systems Co., Ltd.	

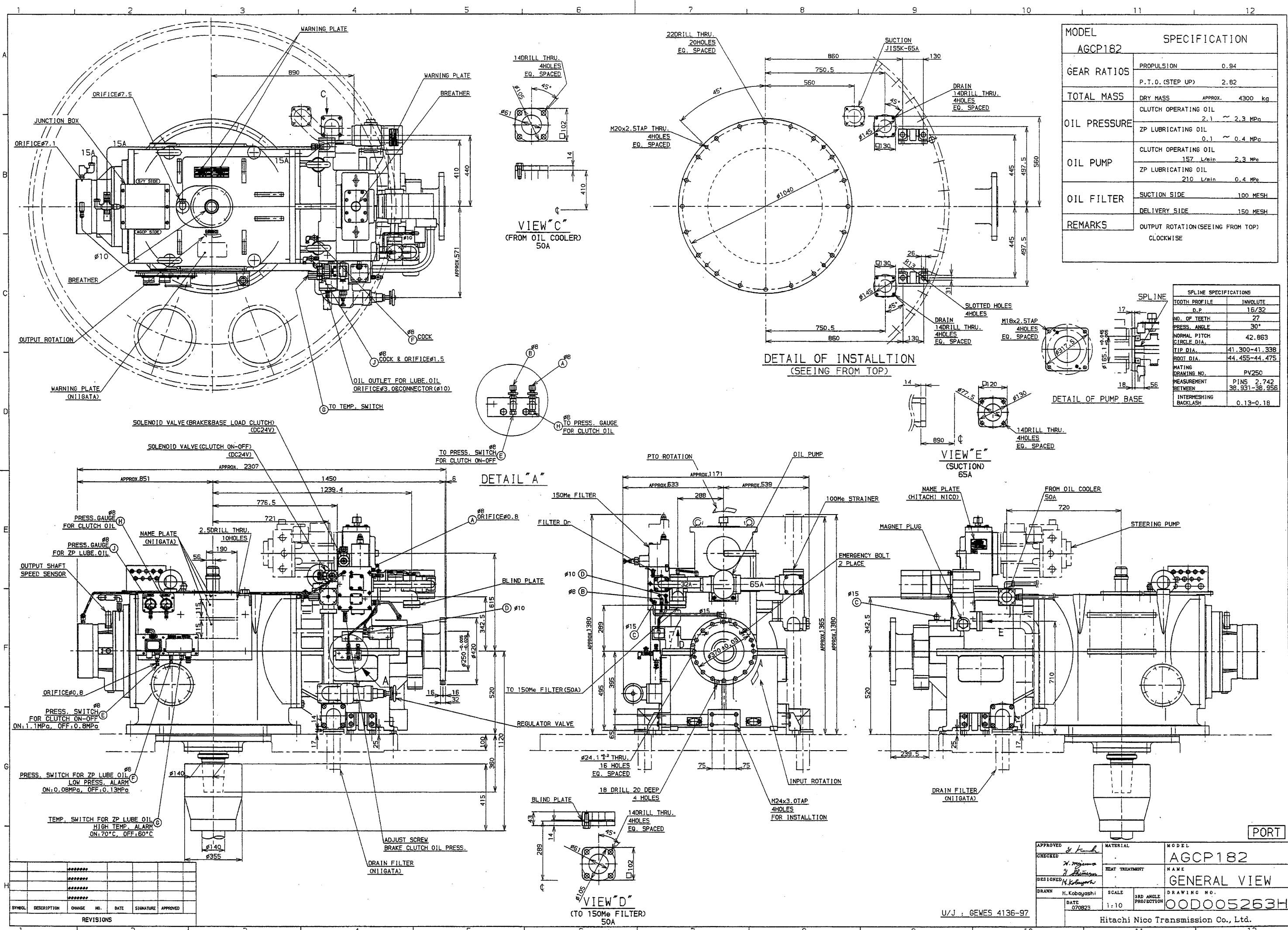
図名 TITLE	クミタゲイケイズ GENERAL VIEW
図番 DRAWING NO.	89W00115A

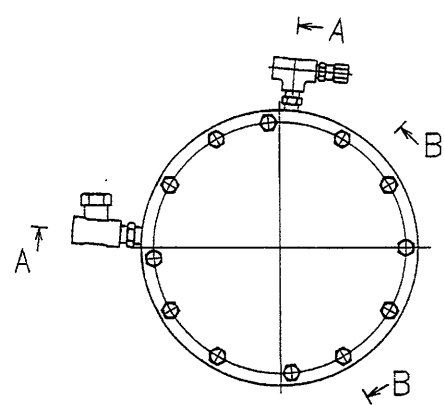
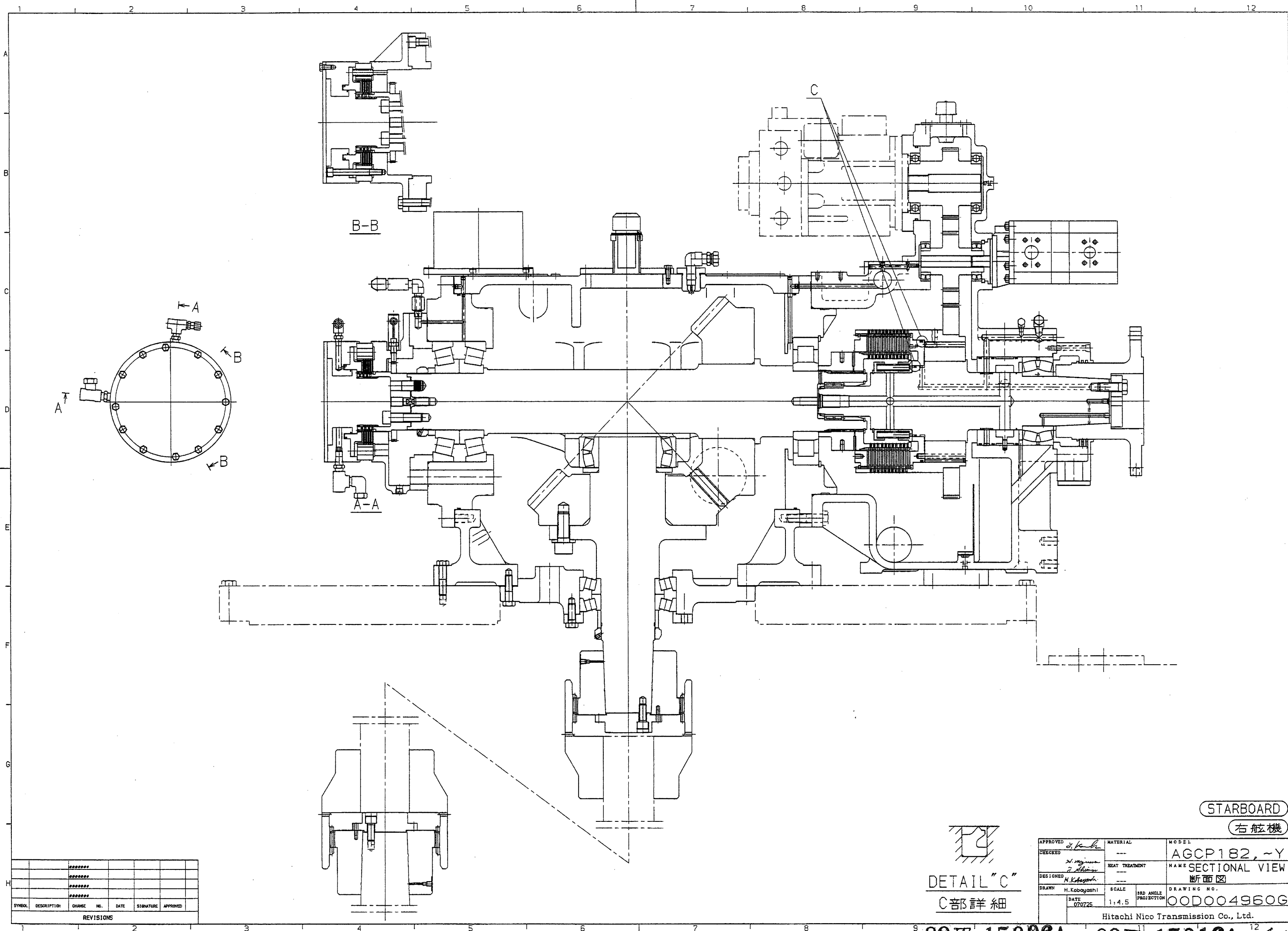


No 92

CLASS No.		_____				
SUB. No.		_____				
MODEL	AGCP182		DRAWING No.	89W 15006A , 89W 15016A		
<u>CLUTCH</u> <u>クラッチ</u>						
WORK No. : K242736						
MARK	REVISION		APPROVED	PASSED	DRAWN DATE	
Niigata Power Systems Co., Ltd. ENGINEERING & TECHNOLOGY CENTER			APPROVED			
			PASSED			
			CHECKED	Y. Oshio		
			DRAWN	Y. Oshio		
			DATE	30-Aug-07		







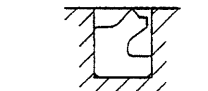
B-B

A-A

C

STARBOARD

右舷機

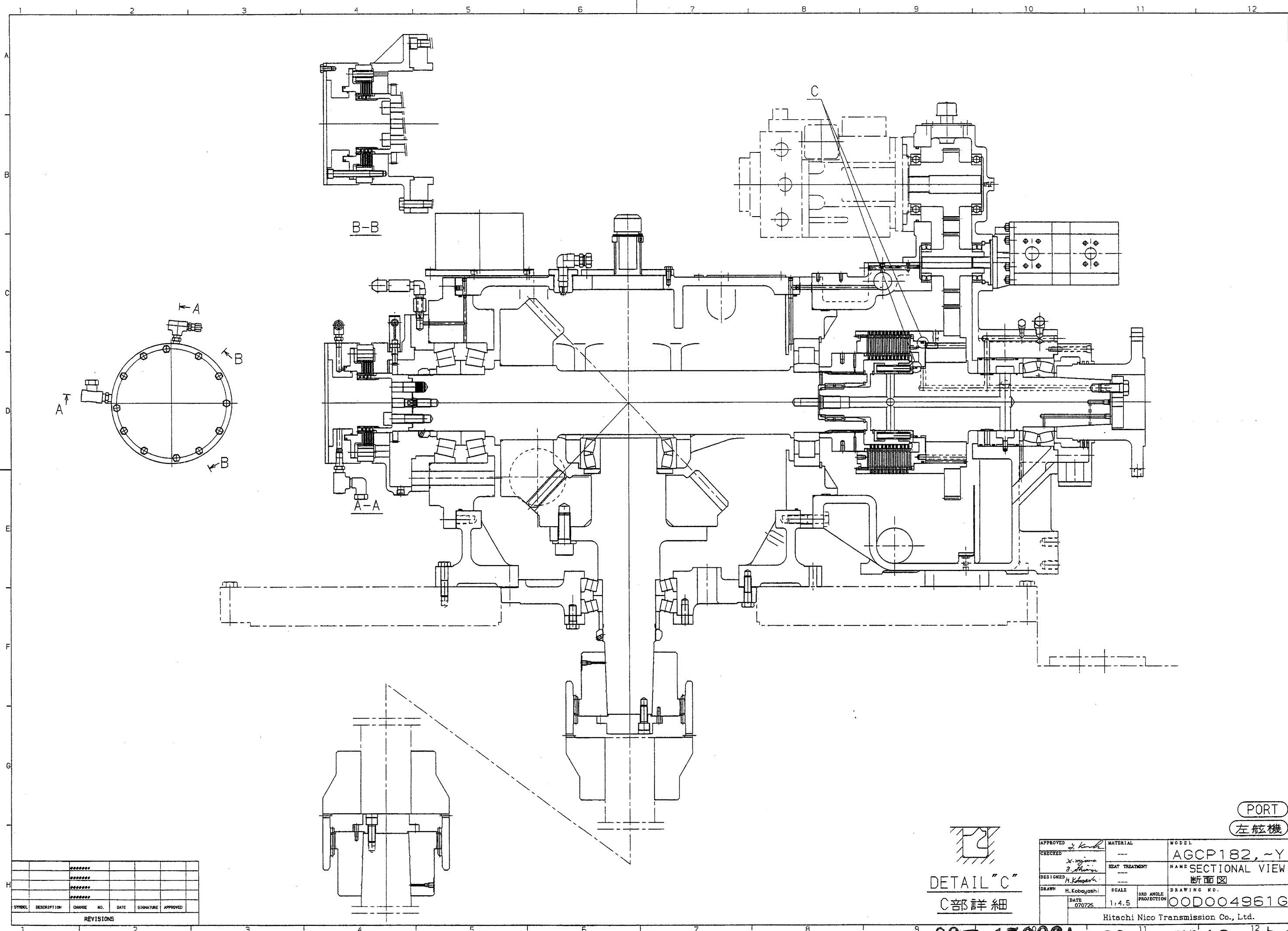


DETAIL "C"  
C部詳細

REVISIONS						
SYMBOL	DESCRIPTION	CHANGE NO.	DATE	SIGNATURE	APPROVED	

APPROVED <i>H. Kobayashi</i>	MATERIAL ---	MODEL AGCP182, ~Y
CHECKED <i>H. Kobayashi</i>	HEAT TREATMENT ---	NAME SECTIONAL VIEW 断面図
DESIGNED <i>H. Kobayashi</i>	SCALE 1:4.5	DRAWING NO. 00D004960G
DRAWN H. Kobayashi	DATE 070725	3RD ANGLE PROJECTION
Hitachi Nico Transmission Co., Ltd.		

89W 15006A 89W 15016A - 4/6



PORT  
左舷機

DETAIL "C"  
C部詳細

SYMBOL	DESCRIPTION	CHANGE NO.	DATE	SIGNATURE	APPROVED
*****					
*****					
*****					
*****					
REVISIONS					

APPROVED <i>[Signature]</i>	MATERIAL ---	MODEL AGCP182, ~Y
CHECKED <i>[Signature]</i>	HEAT TREATMENT ---	NAME SECTIONAL VIEW 断面図
DESIGNED <i>[Signature]</i>	SCALE 1:4.5	DRAWING NO. 00D004961G
DRAWN H. Kobayashi	DATE 070725	3RD ANGLE PROJECTION
Hitachi Neco Transmission Co., Ltd.		

89W 15006A 89W 15016A-5/6





		CLASS. No.			
		SUB. No.			
MODEL		DRAWING No.	979 11958B (1/11)		
<p><b><u>LUB. OIL FILTER</u></b></p> <p><b><u>(FOR ZP UNIT)</u></b></p>					
A	K79-273 ニヨリ調整スル。	S. Eshetu	S. Eshetu	T. Tokitou	2005/01/26
MARK	REVISION	APPROVED	REVIEWED	DRAWN	DATE
<p><b>NIIGATA POWER SYSTEMS CO., LTD.</b></p> <p><b>ENGINEERING &amp; TECHNOLOGY CENTER</b></p>			APPROVED	<b>S. Minami</b>	
			REVIEWED	<b>S. Minami</b>	
			DRAWN	<b>Y. Oshio</b>	
			DATE	Jan. / 26 / 2002	

Part no.: FA7609106-X

X	Pump size
E	PV4-14-DC
F	PV4-14-4
G	PV4-18-DC
H	PV4-18-4

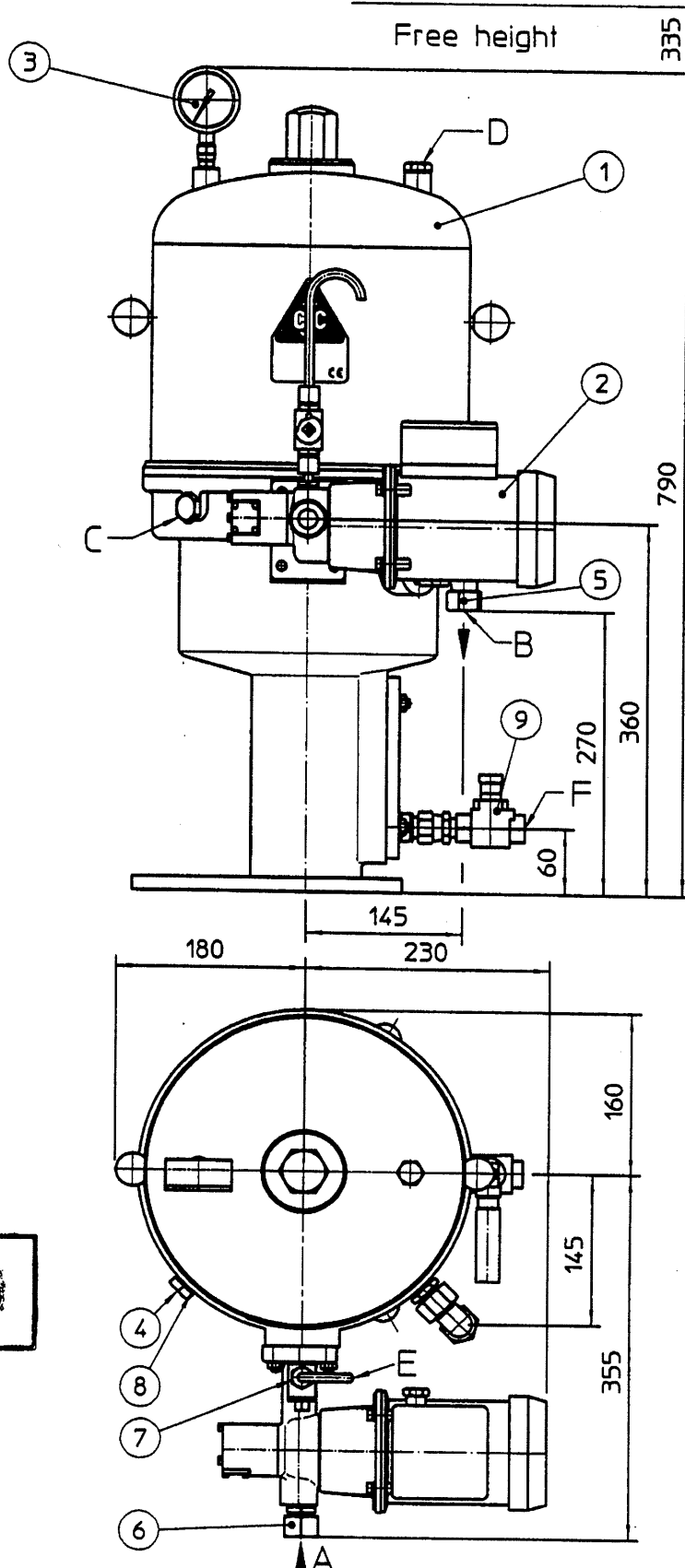
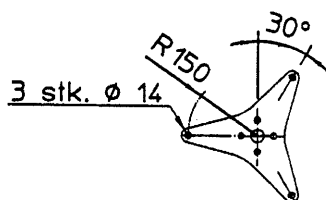
Design pressure 4 bar  
Design temp. 60°C  
Weight 60 kg.

A =  $\varnothing 18$ , Oil inlet, (other size optional)  
B =  $\varnothing 18$ , Oil outlet, (other size optional)  
C = Drain plug  
D = 1/4" BSP Vent  
E = Sampling point  
F = Water outlet

DRAWING No

979 11958B (2/11)

Foundation plan



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Scale:	Customer:	Project:	Ref.:	C.C. JENSEN A/S	Sign	Date
				LIVHOLMEN 13, DK-5700 SVENDBORG, DENMARK FAX NO +45 62 22 44 15 PHONE +45 63 21 20 14	Constr. JSD	00.03.09
				CJC Filter Separator PTU2 27/27 PV General Arrangement	Drawn gj	00.03.09
					Appr.	
					Rev. 1 BGM	01.09.06
					Drawing no.	76 091 06-6

979 11 958 B

CJC™ Filter Separator  
PTU2 27/27 PV  
Drawing No.: 76 091 06-6

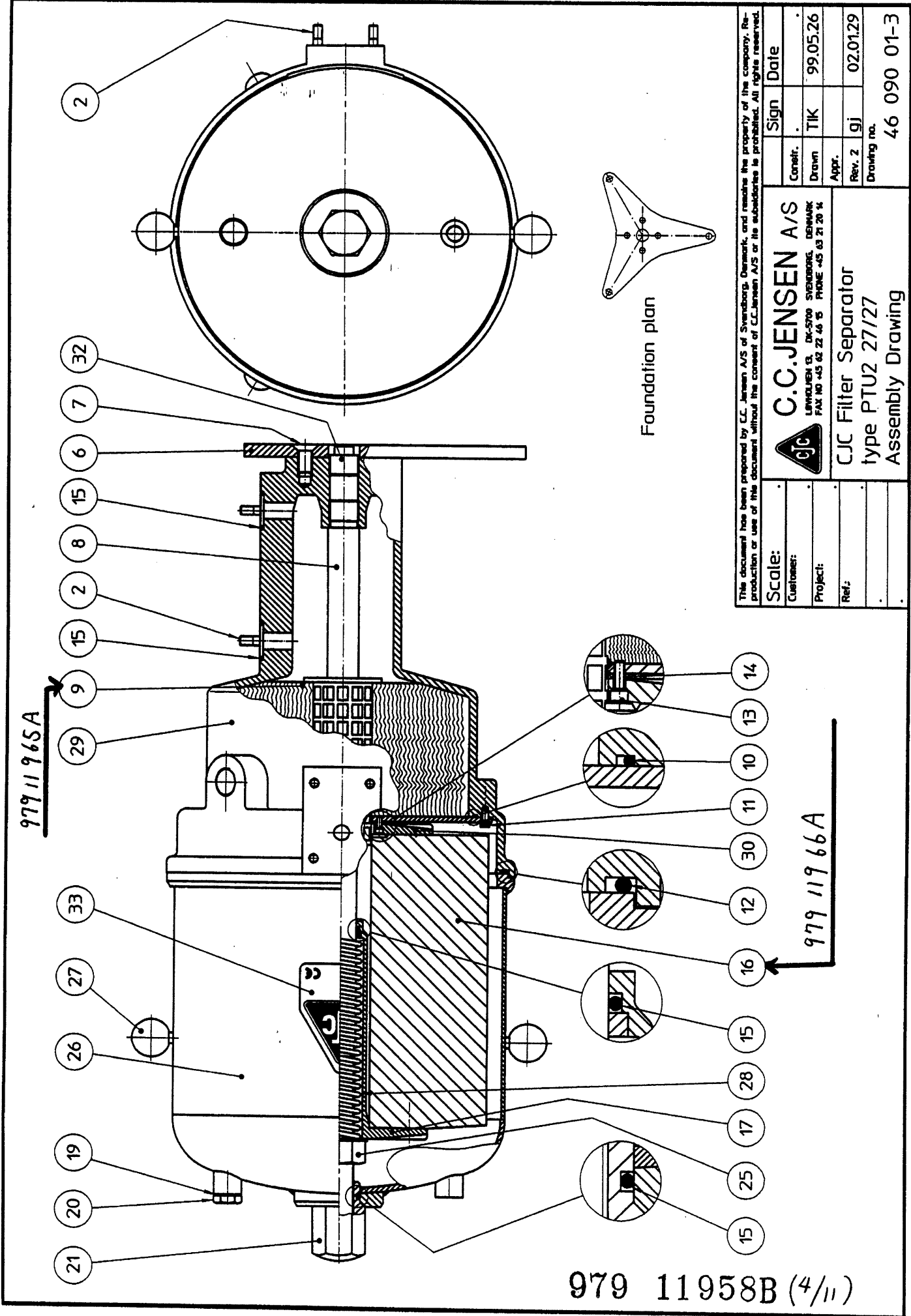
Item group: F2311

Pos.	Article No.	Description	Qty.
1	46 090 01-3 #1	CJC™ Filter separator PTU2	1
2	56 022 14-4 #2	Pump PV4	1
3	FD33006	Pressure gauge ø63 0-4bar	1
4	FD32342	Drain plug 3/8"	1
5	FD32312	Elbow ø18	1
6	FD32260	Profile ring tube fitting ø18x1/2"	1
7	FB5601427	Sampling point	1
8	FD34134	Copper packing 17x22x2,0	1
9	FD32639	Manual water discharge 1/2"	1

- #1 See [Filter separators] under [Spares] under [PTU2 27/27]  
#2 See [Pumps] under [Pump PV4]

DRAWING No

**979 11958B (3/11)**



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Scale:					
Customer:					
Project:					
Ref.:					

<b>C.C. JENSEN A/S</b>		Sign	Date
LIVHOLMEN 13, DK-5700 SVENDSBORG, DENMARK		Contr.	
FAX NO +45 62 22 46 15 PHONE +45 63 21 20 14		Drawn	99.05.26
		Appr.	
		Rev. 2	02.01.29
		Drawing no.	46 090 01-3

**CJC Filter Separator**  
type PTU2 27/27  
Assembly Drawing

CJC™ Filter Separator  
PTU2 27/-  
Drawing No.: 46 090 01-3

Pos.	Article No.	Description	Qty.
2	FD2900201	Stud bolt M8x36	8
6	FD1605012	Base plate f. PTU2	1
7	FD30025	Screw M12x25	4
8	FD1200114	Stay bolt, st. steel	1
9	FB4300208	Coalescer element <i>979 119 65A</i>	1
10		O-ring 240x3	1
	FD34028	Nitrile	
11	FD30039	Screw M6x12, st. steel	6
12		O-ring 295x5	1
	FD34030	Nitrile	
13	FD30016	Screw M4x16, st. steel	4
14		Packing f. filter plate	1
	FD2600210-1	Nitrile	
15		O-ring 28,17x3,53	4
	FD34016	Nitrile	
16		Filter insert <i>979 119 66A</i>	1
	PA5601325	BLAT 27/27	
	PA5600505	F 27/27	
17	FB1600210	Spring guide	1
19		Usit ring 14,7x22x1,5	1
	FD34097	Nitrile	
20	FD2200701	Vent screw 1/4" BSP	1
21	FD2300116	Top nut	1
25	FD2300125	Nut f. spring guide	1
26	FD4800132-27	Filter housing	1
27	FD35107	Ball handle ø40	2
28	FD1600517	Spring 4x38x300	1
29	FC1600124	Filter base	1
30	FD1601003	Filter plate	1
32	FD32018	Plug 3/4"	1
33	FD35138	CJC label	1

DRAWING No

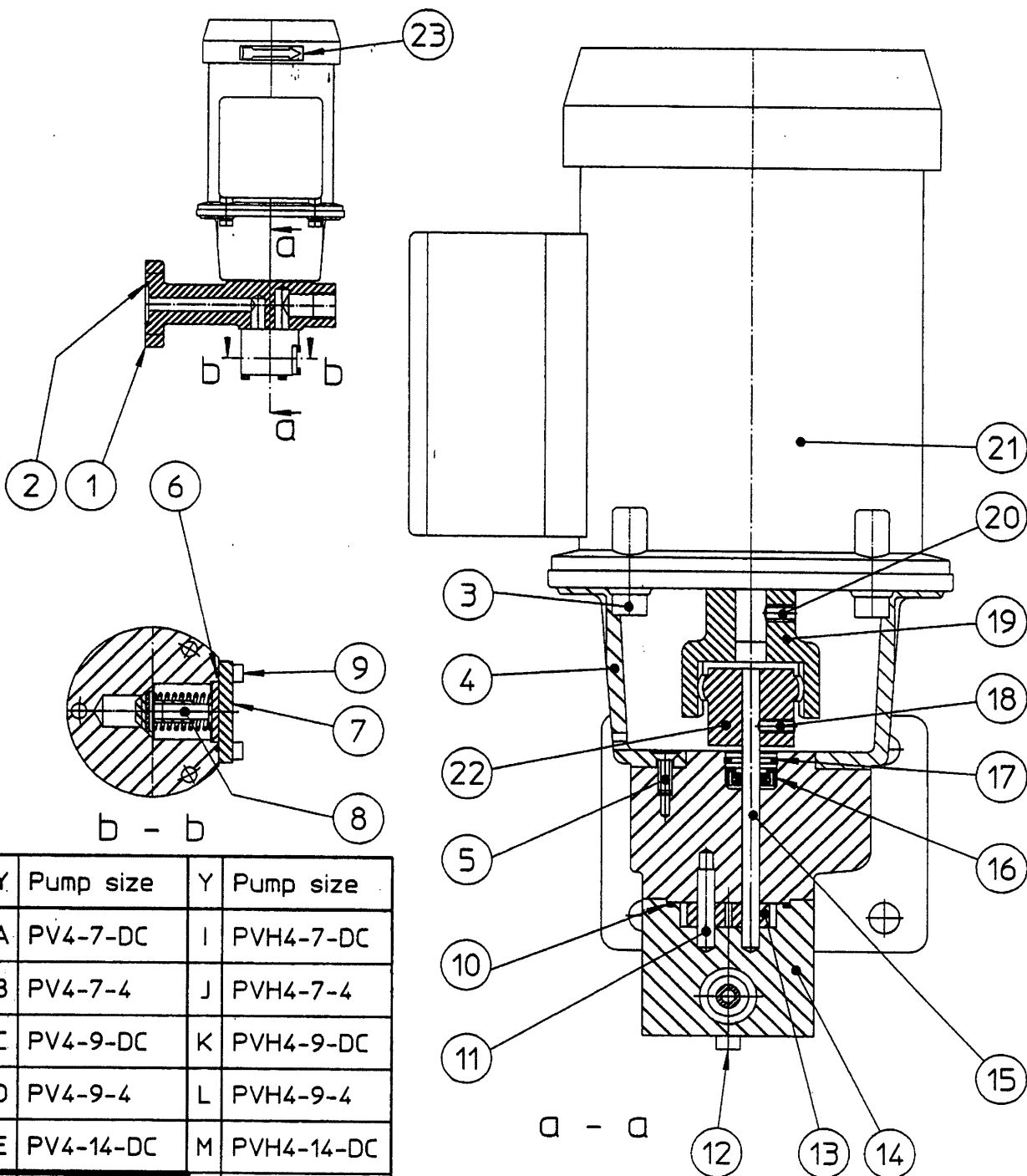
**979 11958B (5/11)**

CJC™ Filter Separator  
PTU2 27/-  
Drawing No.: 46 090 01-3

Pos.	Article No.	Description	Qty.
		Packing set complete f. PTU2 27/27	979 119 67A
	<u>FD34044</u>	Nitrile	Niigata's No
		2 off o-ring 28,17x3,53	
		1 off o-ring 295x5,0	
		1 off o-ring 240x3,0	
		1 off usit ring 14,7x22x1,5	
		Filter plate set	
	FS1000	Nitrile	
		1 off filter plate	
		1 off packing f. filter plate	
		4 off stud CH M4x12	

DRAWING No

979 11958B (6/11)



Y	Pump size	Y	Pump size
A	PV4-7-DC	I	PVH4-7-DC
B	PV4-7-4	J	PVH4-7-4
C	PV4-9-DC	K	PVH4-9-DC
D	PV4-9-4	L	PVH4-9-4
E	PV4-14-DC	M	PVH4-14-DC
<b>F</b>	<b>PV4-14-4</b>	N	PVH4-14-4
G	PV4-18-DC	O	PVH4-18-DC
H	PV4-18-4	P	PVH4-18-4

DRAWING No

**979 11958B (7/11)**

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Scale:			Sign	Date
Customer:			Constr.	JSD 00.12.06
Project:			Drawn	lu 00.12.06
Ref.:			Appr.	
			Rev. 2	lu 03.08.21
			Drawing no.	
			56 022 14-4	



**C.C. JENSEN A/S**

LØVHOLMEN 13, DK-5700 SVENDBORG, DENMARK  
FAX NO +45 62 22 46 15 PHONE +45 63 21 20 14

Pump type PV4 and PVH4  
Assembly Drawing

179 11958B



List of  
components

DRAWING No

979 11958B (8/11)



CJC™ Pump  
Type PV4 & PVH4  
Drawing No.: 56 022 14-4

Pos.	Article No.	Description	Qty.
1		Pump cover/bracket	1
2	FD34085	O-ring 28.17x3.53 Viton	1
3	FD30058	Screw M6x16	4
4	FC2100209	Bell housing	1
5	FD30130	Screw M4x12	3
6	FD34190	O-ring 21,0x1,0 Viton	1
7	FD1400148	Cover f. by-pass valve	1
8	FD32659	By-pass valve	1
9	FD30231	Screw M3x10	4
10	FD34075	O-ring 32,1x1,6 Viton	1
11	FD30102	Shaft 5x20mm	1
12	FD30110	Screw M4x35	3
13		Gear wheel	2
	FD3000307-07	PV4-7	
	FD3000307-09	PV4-9	
	FD3000307-14	PV4-14	
	FD3000307-18	PV4-18	
14		Pump housing	1
	FD2600418-07	PV4-7	
	FD2600418-09	PV4-9	
	FD2600418-14	PV4-14	
	FD2600418-18	PV4-18	
15	FD30105	Shaft 5x80mm	1
16		Shaft seal 5x15x6	1
PV	FD34083	Viton (for pump PV4)	
PVH	FD34277	Teflon (for pump PVH4)	
17	FD30008	Seeger ring	1
18	FD30061	Pivot screw M6x10	1
19		Coupling f. motor	1
	FD33300	for ø11mm shaft	
	FD33301	for ø14mm shaft	
20	FD30129	Pivot screw M5x6	1

CJC™ Pump  
 Type PV4 & PVH4  
 Drawing No.: 56 022 14-4

Pos.	Article No.	Description	Qty.
21		Motor	1
	FD31035	PM80-188A 24V DC	
	FB31000	K21R 63 G4 3-phase	
22	FD2100704	Coupling f. pump	1
23	FD35117	Arrow	1

Packing set, complete f.: 979 119 68A

PV2 FD34217

PV4 -

For Pump PV4  
 For Pump PVH4  
 1 off o-ring 28.17x3.53 viton  
 1 off o-ring 21,0x1,0 viton  
 1 off o-ring 32,1x1,6 viton  
 1 off shaft seal 5x15x6 (see pos. 16)  
 1 off seeger ring

Gear wheel set, complete

FS1008	PV4-7
FS1009	PV4-9
FS1010	PV4-14
FS1011	PV4-18

FS1022	Coupling set f. pump
	1 off coupling f. pump
	1 off pivot screw M6x10

FS1033	Coupling set f. motor with ø11mm shaft
	1 off coupling f. motor ø11mm
	1 off pivot screw M5x6

DRAWING No

**979 11958B (9/11)**

979 11958B (10/11)

Vekselstrøm.  
Alternating Current.

Tre faset.  
Three Phase.

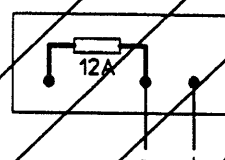
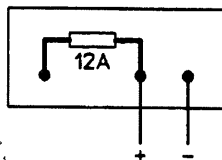
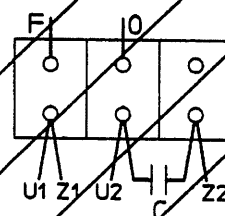
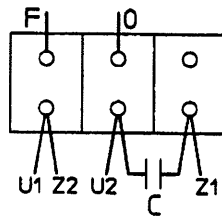
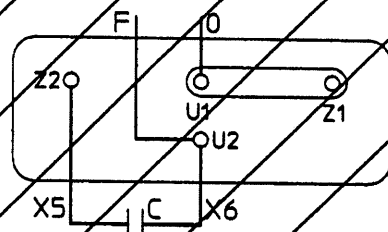
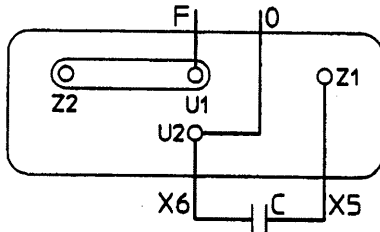
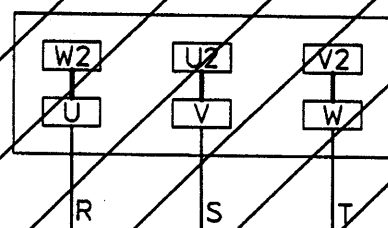
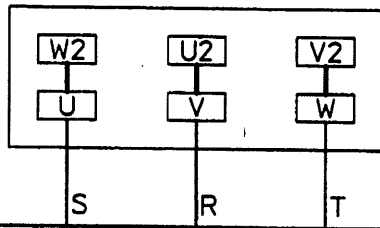
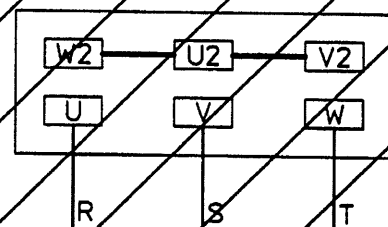
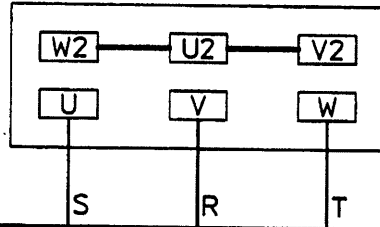
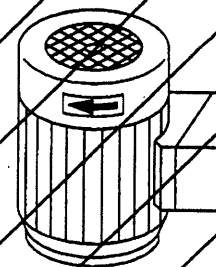
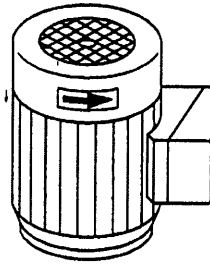
En faset.  
Single Phase.

3x220-240V 50Hz  
3x380-415V 50Hz  
3x255-290V 60Hz  
3x440-575V 60Hz

1x110-240V 50-60Hz

Jævnstrøm.  
Direct Current.

24 V DC



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Scale:

Customer:

Project:

Ref.:



**C.C. JENSEN A/S**

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Tilslutningsdiagram til pumpe type PM/PV.  
Wiring diagram for pump type PM/PV.

Sign Date

Constr. JBK 99.01.07

Drawn lu 99.01.11

Appr.

Rev. 1 lu 00.04.10

Drawing no.

75 003 10-7

979 11958B



## BLAT 27/27

### APPLICATION

The type BLAT FilterInsert is manufactured specially for CJC™ FilterSeparator units employed in the filtration of mineral based oils of up to ISO VG 150 cSt and is used for, typically:

- hydraulic oils
- turbine lubricating oils
- gear oils
- diesel oils

### FILTRATION CAPABILITY

All CJC™ FilterInserts have a filtration degree of 3 µm (micron) absolute (equiv. to 0.8 µm nominal) i.e. 98.7% of all solid particles > 3 µm and approximately 50% of all particles > 0.8 µm are retained in each pass.

The dirt holding capacity of a BLAT 27/27 Insert is 4.0 litres of evenly distributed solids.

Unlike type B Filter Inserts the BLAT 27/27 will not permanently hold water as its free passage is integral to the water separation process.

### DIMENSIONS

The figures below are nominal:

Diameter: 27 cm  
Height: 27 cm  
Weight: 4 kg

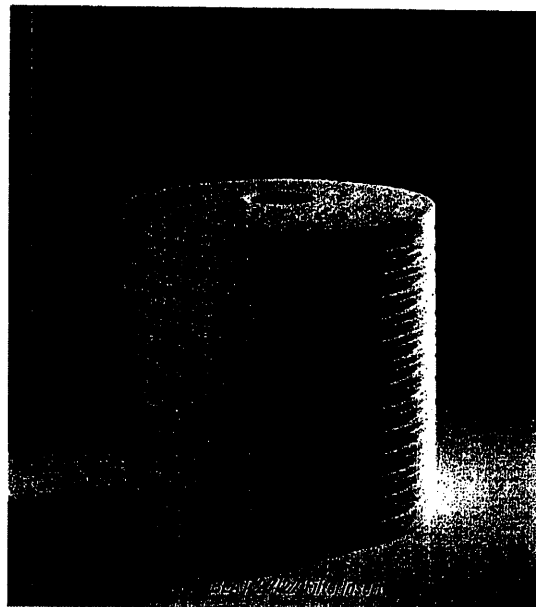
### COMPONENTS

CJC™ Fine Filter Inserts type BLAT consist of bonded discs. Main ingredient is cotton linters.

### IDENTIFICATION

To order the CJC™ BLAT 27/27 FilterInsert, please use:

Article No: PA5601325



The anticipated increase in differential pressure ( $\Delta P$ ), measured in bar, across one new BLAT 27/27 FilterInsert is:

Differential Pressure ( $\Delta P$ ), in bar					
Flow rate, L/h	Viscosity, cSt				
	32	46	68	100	150
200	0.03	0.05	0.07	0.11	0.16
400	0.07	0.10	0.15	0.22	0.32
600	0.10	0.15	0.22	0.32	0.49
800	0.14	0.20	0.29	0.43	0.65

To calculate the differential pressure across several filter inserts, divide the differential pressure reading from the table with the number of filter inserts in a filter housing.

DRAWING No

979 11958B (11/11)

CLASS. No.	2 0 5 4 0
SUB. No.	0 0 5 4 8 H (1/4)

MODEL	Z P - <del>10, 11A,</del> <del>21, 31, 41A,</del> 41	DRAWING No.	_____
-------	---	----------------	-------

**RECOMMENDED BRAND TABLE**  
**FOR**  
**Z-PELLER LUB.OIL**

For clutch built in type.

H	Revised by NES rule.	M. Ikeda	S. Takahashi	27 <sup>th</sup> Oct. 2009
G	Revise Gmark.	T.Tokitou	S.Takahashi	Nov./ 14 / 2007
F	Revise Fmark.	Y.Oshio	S.Ehata	Jan / 22 / 2007
E	Revise Emark.	Y.Oshio	S.Ehata	Jan / 09 / 2007
C	Revise Cmark.	T.Tokitotu	S.Ehata	July / 28 / 2006
B	Revise B mark.	T.Tokitotu	S.Minami	01/Oct./2004
A	Revise A mark.	Y.Oshio	S.Minami	26/Aug./2004
MARK	REVISION	DRAWN	APPROVED	DATE

**Niigata Power Systems Co., Ltd.**

ENGINEERING & TECHNOLOGY CENTER

APPROVED	<i>T.Shiino</i>
REVIEWED	<i>T.Shiino</i>
CHECKED	<i>T.Shiino</i>
DRAWN	<i>T. Higuchi</i>
DATE	4 / Dec. / 2001

CLASS. No.	2 0 5 4 0
SUB. No.	0 0 5 4 8 H (2/4)

## 1 . LUB.OIL FOR Z-PELLER

- 1) Oil Type : Anti-wear Hydraulic Fluid
- 2) Viscosity : ISO VG100
- 3) Oil Test Class : FZG, Load Stage min. 11
- 4) Oil Quantity : ZP-10 ・ ・ Approx. 750 L/UNIT  
: ZP-11A ・ ・ Approx. 1000 L/UNIT  
: ZP-21 ・ ・ Approx. 1000 L/UNIT  
: ZP-31 ・ ・ Approx. 1300 L/UNIT  
: ZP-41A ・ ・ Approx. 1800 L/UNIT  
: ZP-41 ・ ・ Approx. 2500 L/UNIT

E

F

B

- 5) Exchange standard : Lub. oil to be exchanged every 4000 - 6000hr. However, analyze quality every 500 - 750hr, and determine by the opinion of an oil maker. Moreover, check whether oil level is checked every day and there is any change in oil level.  
When sea water mixes by damage on a seal etc., oil level may change.

LUB.OIL FOR Z-PELLER		
OIL MAKER	RECOMMENDED BRAND	
NIPPON OIL CORPORATION	Super Hyland 100	G
JAPAN ENERGY CORPORATION	JOMO Hydracs 100	
Idemitsu Kosan Co., Ltd.	-----	H
Showa Shell Sekiyu K.K. Shell	TELLUS OIL 100	H
-----	-----	H
COSMO OIL LUBRICANTS Co., Ltd.	COSMO Hydrau AW 100	
EXXON MOBIL	DTE 18M NUTO H 100	G
Chevron (Chevron, Caltex and Texaco)	RANDO HD 100	G
TOTAL	VISGA 100	H
Castrol	HYSPIN AWS 100 HYSPIN AWH-M100	H

CLASS. No.	2 0 5 4 0
SUB. No.	0 0 5 4 8H (3/4)

## 2. HYDRAULIC FLUID FOR Z-PELLER (FOR STEERING CONTROL)

- 1) Oil Type : Anti-wear Hydraulic Fluid
- 2) Viscosity : ISO VG46 or VG68 C  
(In case of Z-peller with built-in clutch, we recommend the VG68 oil to the hydraulic oil system as a priority.)
- 3) Oil Test Class : JIS K2213 No.2
- 4) Oil Quantity : ZP-10 ・ ・ Approx. 80L / UNIT E  
: ZP-11A ・ ・ Approx. 80L / UNIT  
: ZP-21 ・ ・ Approx. 80L / UNIT  
: ZP-31 ・ ・ Approx. 120L / UNIT  
: ZP-41A ・ ・ Approx. 120L <sup>(\*)</sup> / UNIT FH  
: ZP-41 ・ ・ Approx. 200L <sup>(\*)</sup> / UNIT BH

Marked (\*) shown net capacity of tank unit because outfitting piping are provided by shipyard. H

- 5) Exchange standard : Lub. oil to be exchanged every 4000 - 6000hr.

The first time is exchanging by 100hr.

[NON-ZINC TYPE]

A/C

HYDRAULIC FLUID FOR Z-PELLER		
OIL MAKER	RECOMMENDED BRAND	
NIPPON OIL CORPORATION	Super Hyland 46 or 68	G
JAPAN ENERGY CORPORATION	JOMO Hydracs 46 or 68	H
Idemitsu Kosan Co., Ltd.	Daphne Super Hydrolic Fluid 46 or 68	H
Showa Shell Sekiyu K.K. Shell	TELLUS OIL 46 or 68	H
COSMO OIL LUBRICANTS Co., Ltd.	COSMO Hydrau AW 46 or 68	H
EXXON MOBIL	MOBIL DTE 25 or 26 MOBIL DTZ 15M UNIPOWER SQ 46 or 68 NUTO H 46	H
Chevron (Chevron, Caltex and Texaco)	HYDRAULIC OIL AW 46 or 68 RANDO HD 46 or 68	H
TOTAL	VISGA 46 or 68	H
Castrol	HYSPIN AWS 46 or 68 HYSPIN ZZ 46	H

CLASS. No.	2 0 5 4 0
SUB. No.	0 0 5 4 8H (4/4)

### 3. GREASE FOR UNIVERSAL JOINT

- 1) Consistency : JIS K2220 No.2  
2) Oil Type : Lithium Soap

GREASE FOR UNIVERSAL JOINT		
OIL MAKER	RECOMMENDED BRAND	
NIPPON OIL CORPORATION	Epnoc Grease AP2	G
JAPAN ENERGY CORPORATION	JOMO Resonics Grease EP2	
Idemitsu Kosan Co., Ltd.	Daphne Eponex Grease SR2	H
Showa Shell Sekiyu K.K. Shell	ALVANIA EP GREASE 2	
COSMO OIL LUBRICANTS Co., Ltd.	COSMO Grease Dinamax EP2	G
EXXON MOBIL	MOBILUX EP2 LITHTAN EP2	
Chevron (Chevron, Caltex and Texaco)	DULA-LITH GREASE EP2 MULTIFAK EP2	H
TOTAL	EPEXA 2	
Castrol	SPHEEROL AP2 SPHEEROL EPL2	G



REV. EXPLAIN DATE DRAW. APPR.

				CLASS No. 2335M	
				SUB. No. 0054 ( 1/42)	
MODEL	8L28HX		JOB No.	K242735 / K242737	
<b>CALCULATION SHEETS OF TORSIONAL VIBRATION</b> <b>FOR</b> <b>2206 kW / 750 min<sup>-1</sup> DIESEL ENGINE</b>					
OWNER	MESSRS. JAYA SHIPBUILDING & ENGEERING TED LTD.				
SHIPYARD	MESSRS. PT. JAYA ASIATIC SHIPYARD				
SHIP No.	888B / 889B		SHIP NAME		
RULE	AMERICAN BUREAU OF SHIPPING (A. B. S.)				

## NOTE :

1. In these calculation sheets, we draw the allowable torsional stress curve of crankshaft based on the calculation of crankshaft sheets no. 2325M-00005.
2. In these calculation sheets, we draw the minimum allowable stress of shaft by using  $U=400 \text{ N/mm}^2$  and  $C_k=0.6$  (keyways, at PTO), based on Rules 4-3-2/7.5, when the material property of shaft is unknown.

## CONCLUSION :

## 1. At normal firing

Dangerous stress and amplitude do not occur. But, 0-300 min<sup>-1</sup> of engine speed should be prohibited so that 4th order amplitude is too large (see page 10/42-11/42).

## 2. At No.8 cylinder misfiring (about the worst misfiring condition, see appendix pages)

2-1. 0.5th, 1.0st, and 1.5th order vibration remarkably increase compare with values of same order at normal firing, so 0-300 min<sup>-1</sup> of engine speed should be prohibited (see page 15/42).

2-2. At the shafting of generator driving system, 0.5th, 1.0st, and 1.5th order vibratory stress is too large, and the sum of vibratory stress exceeds the permissible stress curve. Then above 730 min<sup>-1</sup> of engine speed should be added for barred range (see page 27/42).

2-3. With regard to the calculation results of other 1 cylinder misfiring condition, see the appendix pages.

In spite of misfiring operating condition, this shafting system is safety enough and free from dangerous torsional vibration except the below barred range.

## BARRED RANGE :

	AT NORMAL FIRING	AT NO. 8 CYLINDER MISFIRING
FORWARD	0-300min <sup>-1</sup>	0-300min <sup>-1</sup>
FORWARD and GENERATOR ON	—	above 730min <sup>-1</sup>
GENERATOR ON	—	—

IDLING SPEED : 400 min<sup>-1</sup>

NIIGATA POWER SYSTEMS CO., LTD.  
ENGINEERING & TECHNOLOGY CENTER

APPROVED

S. Yamataka

REVIEWED

S. Yamataka

DRAWN

M. Sugimoto

DATE

4th-Feb., 2008

PARTICULARS

## 1. ENGINE

MODEL	8L28HX
MAXIMUM CONTINUOUS OUTPUT	2206 kW
RATED SPEED	750 min <sup>-1</sup>
DIAMETER OF CYLINDER	280 mm
LENGTH OF STROKE	370 mm
NUMBER OF CYLINDERS	8
FIRING ORDER	1-3-2-5-8-6-7-4
CON-ROD LENGTH	710 mm
RECIPROCATING PART WEIGHT	90.3 kg

## 2. Z-TYPE PROPULSION UNIT

MODEL	ZP-41CP
REDUCTION RATIO	3.099
PROPELLER DIAMETER	2700 mm
NUMBER OF BLADES	4

## 3. CLUTCH (INCLUDED TO Z-TYPE PROPULSION UNIT)

MODEL	AGCP182
-------	---------

## 4. GENERATOR

MAXIMUM POWER	1000 kW
RATED SPEED (AT ENGINE SPEED)	750 min <sup>-1</sup>

## 5. FLEXIBLE COUPLING

## STERN SIDE (GEISLINGER COUPLING)

MODEL	BE72/15/140U-12
NOMINAL TORQUE	36.8 kN·m
TORSIONAL STIFFNESS	0.266 MN·m/rad
CHARACTERISTIC FREQUENCY	120.0 rad/s
RELATIVE DAMPING TORQUE	2.21 kN·m /bar
PERMISSIBLE POWER LOSS	4.2 kW

## BOW SIDE BETWEEN ENGINE AND GEARBOX (STROMAG COUPLING)

MODEL	PVN66631W
NOMINAL TORQUE	20.0 kN·m
TORSIONAL STIFFNESS (WARM CONDITION)	0.1348 MN·m/rad
PERMISSIBLE VIBRATORY TORQUE	10.0 kN·m
PERMISSIBLE POWER LOSS	0.99 kW
RELATIVE DAMPING FACTOR (NON-DIMENSION)	0.96

# BOW SIDE BETWEEN GEARBOX AND GENERATOR(STROMAG COUPLING)

MODEL	PVN54931W
NOMINAL TORQUE	9.0 kN·m
TORSIONAL STIFFNESS(WARM CONDITION)	0.1015 MN·m/rad
PERMISSIBLE VIBRATORY TORQUE	4.5 kN·m
PERMISSIBLE POWER LOSS	0.583 kW
RELATIVE DAMPING FACTOR(NON-DIMENSION)	0.96

## 6. MASS MOMENT OF INERTIA-TORSIONAL STIFFNESS SYSTEM

FORWARD	: SEE PAGE 4/42-5/42
FORWARD and GENERATOR ON	: SEE PAGE 4/42-5/42
GENERATOR ON	: SEE PAGE 32/42

## 7. RESULT OF CALCULATION

### 7-1. NATURAL FREQUENCY

NATURAL FREQUENCY (min <sup>-1</sup> )							
	1 NODE	2 NODE	3 NODE	4 NODE	5 NODE	6 NODE	7 NODE
FORWARD / FORWARD and GENERATOR ON	255	441	976	1520	2283	2433	4748
GENERATOR ON	320	706	1375	1521	2433	4764	

### 7-2. HOLZER TABULATION(WITHOUT DAMPING)

FORWARD / FORWARD and GENERATOR ON	: SEE PAGE 6/42-9/42
GENERATOR ON	: SEE PAGE 33/42-34/42

### 7-3. STRESS CALCULATION

FORWARD	
AT NORMAL FIRING CONDITION	: SEE PAGE 10/42-13/42
AT NO.8 CYL. MISFIRING CONDITION	: SEE PAGE 14/42-17/42
FORWARD and GENERATOR ON	
AT NORMAL FIRING CONDITION	: SEE PAGE 18/42-24/42
AT NO.8 CYL. MISFIRING CONDITION	: SEE PAGE 25/42-31/42
GENERATOR ON	
AT NORMAL FIRING CONDITION	: SEE PAGE 35/42-38/42
AT NO.8 CYL. MISFIRING CONDITION	: SEE PAGE 39/42-42/42

— TABLE OF MASS MOMENT OF INERTIA & TORSIONAL STIFFNESS —

FORWARD / FORWARD and GENERATOR ON

NO.	NAME	MASS MOMENT OF INERTIA [kg·m <sup>2</sup> ]	TORSIONAL STIFFNESS [MN·m/rad]	MINIMUM DIAMETER [mm]	MATERIAL	TENSILE STRENGTH [N/mm <sup>2</sup> ]	SHAFT TYPE	REDUCTION RATIO
1	ROTOR	19.10	4.794	120.0	*	*	KEY WAY	0.4167
2	STM. C.	1.162	0.1015	---	---	---	---	0.4167
3	STM. C.	3.422	4.32	110.0	*	*	KEY WAY	0.4167
4	PTOGEAR	0.259	INFINITE	---	---	---	---	0.4167
5	PTOGEAR	3.180	4.44	115.0	*	*	KEY WAY	1.000
6	STM. C.	8.9845	0.1348	---	---	---	---	1.000
7	STM. C.	4.7585	42.856	170.0	*	*	INTERMEDIATE	1.000
8	FLANGE	1.429	INFINITE	---	---	---	---	1.000
L → connect to No. 33								
10	PROPELLER	1151.0	40.84	260.0	SF590A	590.0	PROPELLER	3.099
11	BEVEL GEAR 4	99.57	INFINITE	---	---	---	---	3.099
12	BEVEL GEAR 3	0.654	5.863	139.0	17CrNiMo6	980.0	SHRINK FIT	0.935
13	GEAR COUPLING	3.81	3.576	139.0	SF590A	590.0	SHRINK FIT	0.935
14	GEAR COUPLING	3.156	9.8	139.0	SF590A	590.0	SHRINK FIT	0.935
15	BEVEL GEAR 2	5.56	INFINITE	---	---	---	---	0.935
16	BEVEL GEAR 1	5.56	27.2	160.6	17CrNiMo6	980.0	SHRINK FIT	1.000
17	CLUTCH	8.781	11.6	140.0	S45C	680.0	SHRINK FIT	1.000
18	FLANGE+UNIV. J.	5.345	5.34	---	---	---	---	1.000
19	UNIV. J. + FLANGE	5.31	0.323	139.0	SF590A	590.0	SHRINK FIT	1.000
20	FLANGE+UNIV. J.	5.31	5.34	---	---	---	---	1.000
21	UNIV. J. + FLANGE	5.51	2.191	139.0	SF590A	590.0	SHRINK FIT	1.000
22	FLANGE+G. L. C.	56.86	0.266	---	---	---	---	1.000
23	FLYWHEEL+G. L. C.	33.23	57.35	215.0	CrMo STEEL	780.0	CRANK	1.000
24	NO. 1 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
25	NO. 2 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
26	NO. 3 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
27	NO. 4 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
28	NO. 5 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
29	NO. 6 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
30	NO. 7 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000

(CONTINUE TO NEXT PAGE)

CLASS, SUB NO.

2335M-0054 ( 4/42)

— TABLE OF MASS MOMENT OF INERTIA &amp; TORSIONAL STIFFNESS —

## FORWARD / FORWARD and GENERATOR ON

NO.	NAME	MASS MOMENT OF INERTIA [kg·m <sup>2</sup> ]	TORSIONAL STIFFNESS [MN·m/rad]	MINIMUM DIAMETER [mm]	MATERIAL	TENSILE STRENGTH [N/mm <sup>2</sup> ]	SHAFT TYPE	REDUCTION RATIO
31	NO. 8 THROW	14.13	47.61	160.0	CrMo STEEL	780.0	CRANK	1.000
32	GEAR	0.981	47.15	158.0	CrMo STEEL	780.0	CRANK	1.000
33	DAMPER INNER	2.587	0.701	-----	-----	-----	-----	1.000
34	DAMPER OUTER	10.67						1.000

UNIV. J. : UNIVERSAL JOINT    G. L. C. : GEISLINGER COUPLING    STM. C. : STROMAG COUPLING

- NOTE : 1. Above system(for propeller, etc.) is not changed to engine speed.  
 2. The mass moment of inertia of propeller involves the added mass of sea water.  
 3. About the asterisk(\*), please be referred to the values that maker announced.

## NATURAL FREQUENCIES BY HOLZER TABULATION (WITHOUT DAMPING)

NODE= 1  
 $\omega$ = 26.7230 rad/s  
 F= 4.2531 Hz  
 = 255.186 min<sup>-1</sup>

NODE= 2  
 $\omega$ = 46.1315 rad/s  
 F= 7.3421 Hz  
 = 440.523 min<sup>-1</sup>

MASS NO	RELATIVE AMP	RELATIVE TORQUE
【BRANCH-1】		
1	28.6106	2.2478
2	28.5292	2.3841
3	24.4512	2.7283
4	24.3416	2.7542
5	24.3416	2.8095
6	23.7088	2.9616
7	1.7382	2.9675
8	1.6690	2.9692
33	1.6690	
【MAIN】		
10	-21.9568	-1.8792
11	-21.5149	-2.0385
12	-21.5149	-2.0500
13	-21.2092	-2.1160
14	-20.6919	-2.1693
15	-20.4984	-2.2624
16	-20.4984	-2.3438
17	-20.4123	-2.4718
18	-20.1992	-2.5489
19	-19.7218	-2.6237
20	-11.5989	-2.6677
21	-11.0993	-2.7114
22	-9.8618	-3.1118
23	0.9461	-3.0894
24	1.0000	-3.0793
25	1.0785	-3.0684
26	1.1567	-3.0567
27	1.2346	-3.0442
28	1.3122	-3.0310
29	1.3895	-3.0170
30	1.4664	-3.0022
31	1.5429	-2.9866
32	1.6057	-2.9855
33	1.6690	-0.0132
34	1.6878	-0.0003

MASS NO	RELATIVE AMP	RELATIVE TORQUE
【BRANCH-1】		
1	-0.6047	-0.1416
2	-0.5996	-0.1501
3	-0.3428	-0.1645
4	-0.3362	-0.1656
5	-0.3362	-0.1678
6	-0.2984	-0.1735
7	0.9890	-0.1635
8	0.9928	-0.1605
33	0.9928	
【MAIN】		
10	-0.6881	-0.1755
11	-0.6468	-0.1898
12	-0.6468	-0.1908
13	-0.6184	-0.1965
14	-0.5703	-0.2009
15	-0.5524	-0.2084
16	-0.5524	-0.2149
17	-0.5445	-0.2251
18	-0.5251	-0.2311
19	-0.4818	-0.2365
20	0.2504	-0.2337
21	0.2942	-0.2302
22	0.3993	-0.1819
23	0.9981	-0.1113
24	1.0000	-0.0813
25	1.0021	-0.0511
26	1.0034	-0.0210
27	1.0039	0.0092
28	1.0037	0.0394
29	1.0027	0.0695
30	1.0009	0.0996
31	0.9984	0.1297
32	0.9956	0.1317
33	0.9928	-0.0233
34	1.0261	0.0000

## NATURAL FREQUENCIES BY HOLZER TABULATION (WITHOUT DAMPING)

NODE= 3  
 $\omega = 102.2158$  rad/s  
 $F = 16.2682$  Hz  
 $= 976.089$  min<sup>-1</sup>

NODE= 4  
 $\omega = 159.2199$  rad/s  
 $F = 25.3406$  Hz  
 $= 1520.438$  min<sup>-1</sup>

MASS NO	RELATIVE AMP	RELATIVE TORQUE
[BRANCH-1]		
1	-0.1571	-0.1806
2	-0.1505	-0.1911
3	0.1763	-0.1548
4	0.1825	-0.1519
5	0.1825	-0.1459
6	0.2154	-0.1257
7	1.1475	-0.0686
8	1.1491	-0.0514
33	1.1491	
[MAIN]		
10	0.7966	0.9974
11	0.5620	1.0583
12	0.5620	1.0627
13	0.4035	1.0811
14	0.1393	1.0863
15	0.0423	1.0891
16	0.0423	1.0916
17	0.0022	1.0918
18	-0.0919	1.0867
19	-0.2954	1.0703
20	-3.6090	0.8701
21	-3.7719	0.6529
22	-4.0699	-1.7649
23	0.9751	-1.4264
24	1.0000	-1.2787
25	1.0326	-1.1263
26	1.0613	-0.9696
27	1.0860	-0.8093
28	1.1067	-0.6459
29	1.1231	-0.4801
30	1.1354	-0.3125
31	1.1433	-0.1437
32	1.1463	-0.1320
33	1.1491	-0.1523
34	1.3664	0.0000

MASS NO	RELATIVE AMP	RELATIVE TORQUE
[BRANCH-1]		
1	5.5172	15.3876
2	4.9600	16.2292
3	-22.7994	4.8367
4	-22.9938	3.9671
5	-22.9938	2.1134
6	-23.4698	-3.2322
7	0.5079	-3.1709
8	0.5819	-3.1498
33	0.5819	
[MAIN]		
10	0.0459	0.1394
11	0.0131	0.1428
12	0.0131	0.1430
13	-0.0082	0.1421
14	-0.0430	0.1382
15	-0.0553	0.1293
16	-0.0553	0.1215
17	-0.0598	0.1082
18	-0.0691	0.0988
19	-0.0876	0.0870
20	-0.3570	0.0390
21	-0.3643	-0.0119
22	-0.3589	-0.5293
23	1.0055	0.3178
24	1.0000	0.6760
25	0.9828	1.0281
26	0.9566	1.3707
27	0.9216	1.7009
28	0.8783	2.0155
29	0.8269	2.3117
30	0.7680	2.5867
31	0.7020	2.8382
32	0.6424	2.8542
33	0.5819	-0.2575
34	0.9492	-0.0007

## NATURAL FREQUENCIES BY HOLZER TABULATION (WITHOUT DAMPING)

NODE= 5  
 $\omega = 239.0893$  rad/s  
 $F = 38.0523$  Hz  
 $= 2283.135$  min<sup>-1</sup>

NODE= 6  
 $\omega = 254.8111$  rad/s  
 $F = 40.5545$  Hz  
 $= 2433.267$  min<sup>-1</sup>

MASS NO	RELATIVE AMP	RELATIVE TORQUE
[BRANCH-1]		
1	-0.0304	-0.1911
2	-0.0235	-0.2000
3	0.3187	0.1590
4	0.3123	0.1857
5	0.3123	0.2424
6	0.2577	0.3748
7	-2.5227	-0.3114
8	-2.5154	-0.5169
33	-2.5154	
[MAIN]		
10	74.9068	513.1847
11	-45.7721	486.0574
12	-45.7721	484.1000
13	-117.9556	454.7140
14	-229.1196	407.4319
15	-265.4652	310.9203
16	-265.4652	226.5474
17	-273.7942	89.1152
18	-281.4765	3.1128
19	-282.0595	-82.5033
20	-26.6313	-90.5869
21	-9.6674	-93.6319
22	33.0674	13.8479
23	1.2840	16.2869
24	1.0000	17.0946
25	0.5642	17.5503
26	0.1169	17.6447
27	-0.3329	17.3758
28	-0.7758	16.7492
29	-1.2028	15.7777
30	-1.6050	14.4813
31	-1.9741	12.8868
32	-2.2448	12.7609
33	-2.5154	11.8721
34	-19.4513	0.0080

MASS NO	RELATIVE AMP	RELATIVE TORQUE
[BRANCH-1]		
1	-0.0009	-0.0066
2	-0.0007	-0.0069
3	0.0112	0.0074
4	0.0109	0.0084
5	0.0109	0.0107
6	0.0085	0.0156
7	-0.1072	-0.0175
8	-0.1068	-0.0274
33	-0.1068	
[MAIN]		
10	-0.0359	-0.2794
11	0.0298	-0.2594
12	0.0298	-0.2579
13	0.0683	-0.2386
14	0.1266	-0.2089
15	0.1452	-0.1490
16	0.1452	-0.0965
17	0.1488	-0.0117
18	0.1498	0.0403
19	0.1422	0.0893
20	-0.1343	0.0430
21	-0.1423	-0.0079
22	-0.1387	-0.5201
23	1.0297	1.7015
24	1.0000	2.6190
25	0.9332	3.4752
26	0.8447	4.2501
27	0.7363	4.9256
28	0.6108	5.4860
29	0.4709	5.9180
30	0.3201	6.2116
31	0.1617	6.3600
32	0.0281	6.3618
33	-0.1068	6.3164
34	-9.1174	0.0000



## NATURAL FREQUENCIES BY HOLZER TABULATION (WITHOUT DAMPING)

NODE= 7  
 $\omega = 497.2059$  rad/s  
 $F = 79.1328$  Hz  
 $= 4747.967$  min<sup>-1</sup>

MASS NO	RELATIVE AMP	RELATIVE TORQUE
【BRANCH-1】		
1	-0.0009	-0.0256
2	0.0000	-0.0256
3	0.0438	0.1878
4	0.0362	0.2011
5	0.0362	0.2296
6	-0.0155	0.1952
7	-1.4639	-1.5268
8	-1.4283	-2.0314
33	-1.4283	
【MAIN】		
10	-0.0605	-1.7937
11	0.3613	-0.8678
12	0.3613	-0.8009
13	0.4807	-0.2831
14	0.5499	0.2077
15	0.5314	1.0431
16	0.5314	1.7735
17	0.4662	2.7854
18	0.2260	3.0840
19	-0.3515	2.6226
20	-8.4711	-8.4974
21	-6.8798	-17.8688
22	1.2757	0.0633
23	1.1685	9.6622
24	1.0000	13.1554
25	0.6647	15.4771
26	0.2701	16.4207
27	-0.1484	15.9022
28	-0.5538	13.9677
29	-0.9098	10.7895
30	-1.1849	6.6506
31	-1.3544	1.9195
32	-1.3947	1.5813
33	-1.4283	-1.3636
34	0.5169	-0.0001

# FORWARD

2335M-0054 (10/42)

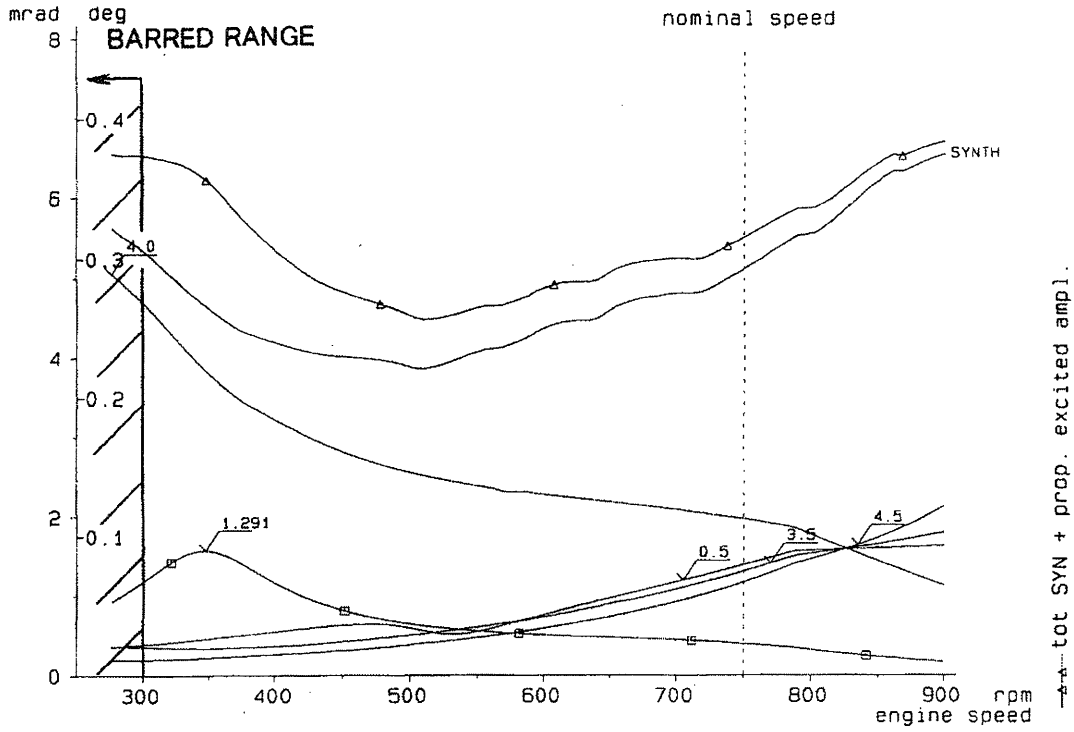
Engine : 8L28HX  
Normal firing

Propeller law up to 787.5 rpm

CN 0  
29-JAN-88  
V 7.0-01

VIBRATORY ANGLE AT FREE END

Inertia no.33  
(AMFRE)

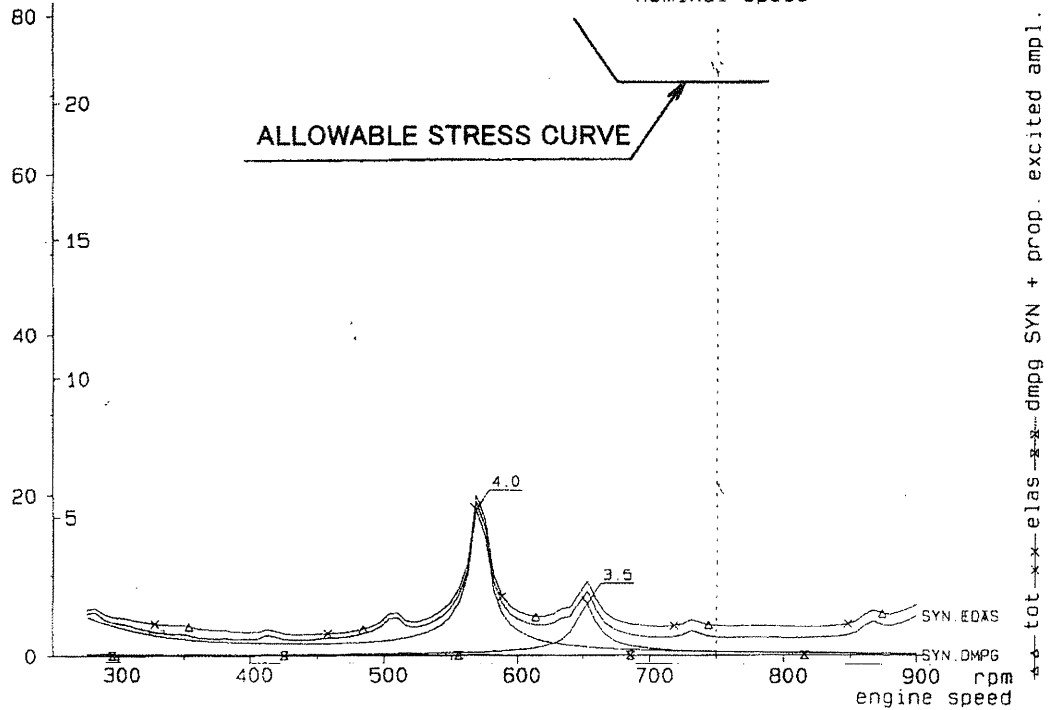


VIBRATORY TORQUE AND STRESS PROPELLER SHAFT  
Results referred to real speed 1 : 3.0990

Between no.10 - 11  
(PROP)

Ø260 mm

nominal speed



# FORWARD

2335M-0054 (11/42)

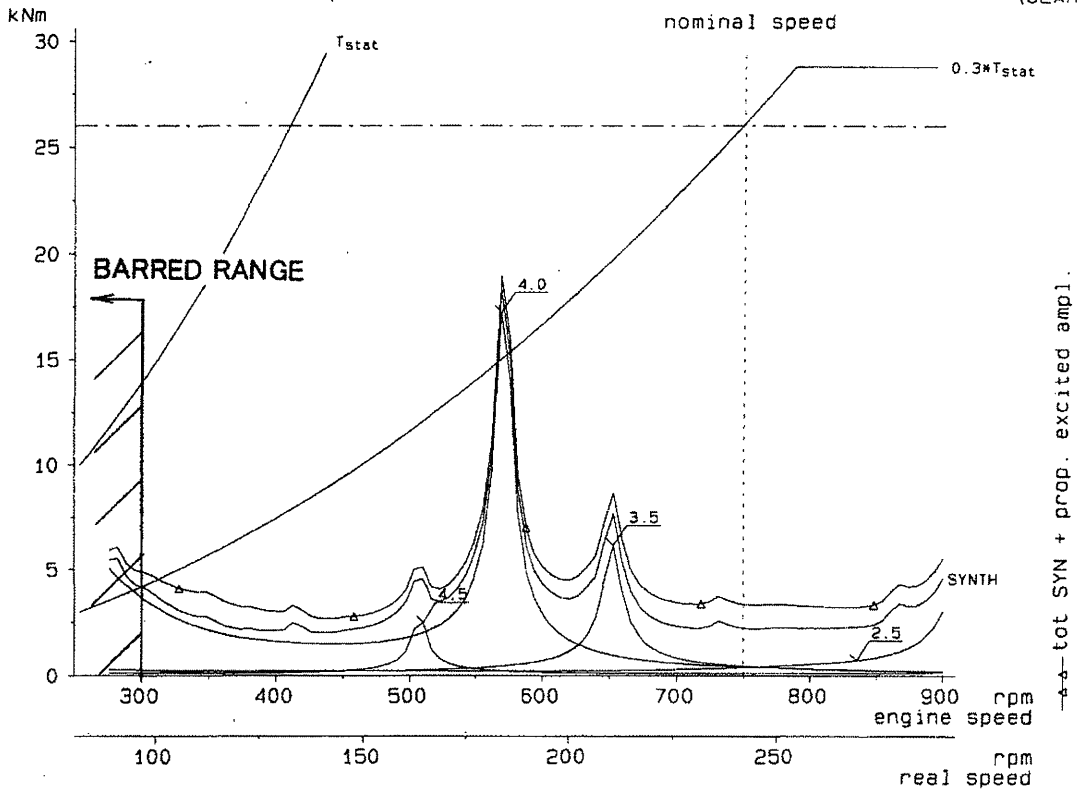
Engine : 8L28HX  
Normal firing

Propeller law up to 787.5 rpm

CN 0  
29-JAN-\*\*  
V 7.0-01

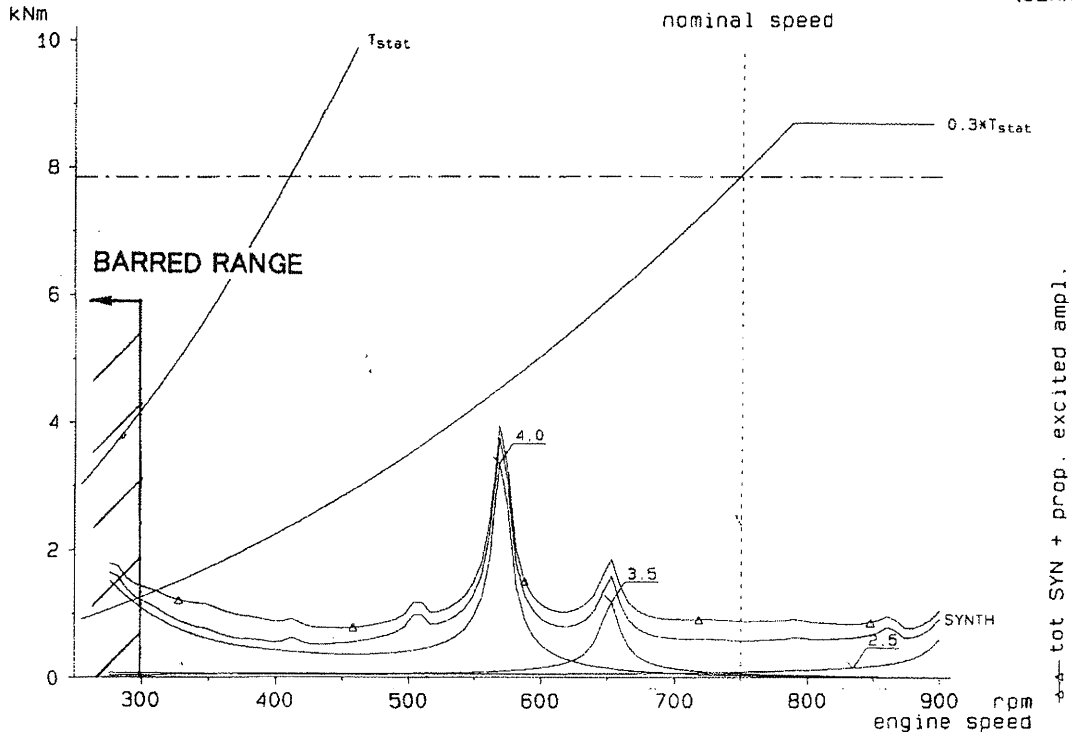
VIBRATORY TORQUE LOWER BEVELGEAR  
Results referred to real speed 1 : 3.0990

Between no.11 - 12  
(GEAR)



VIBRATORY TORQUE UPPER BEVELGEAR  
Results referred to real speed 1 : 0.9350

Between no.15 - 16  
(GEAR)



# FORWARD

2335M-0054 (12/42)

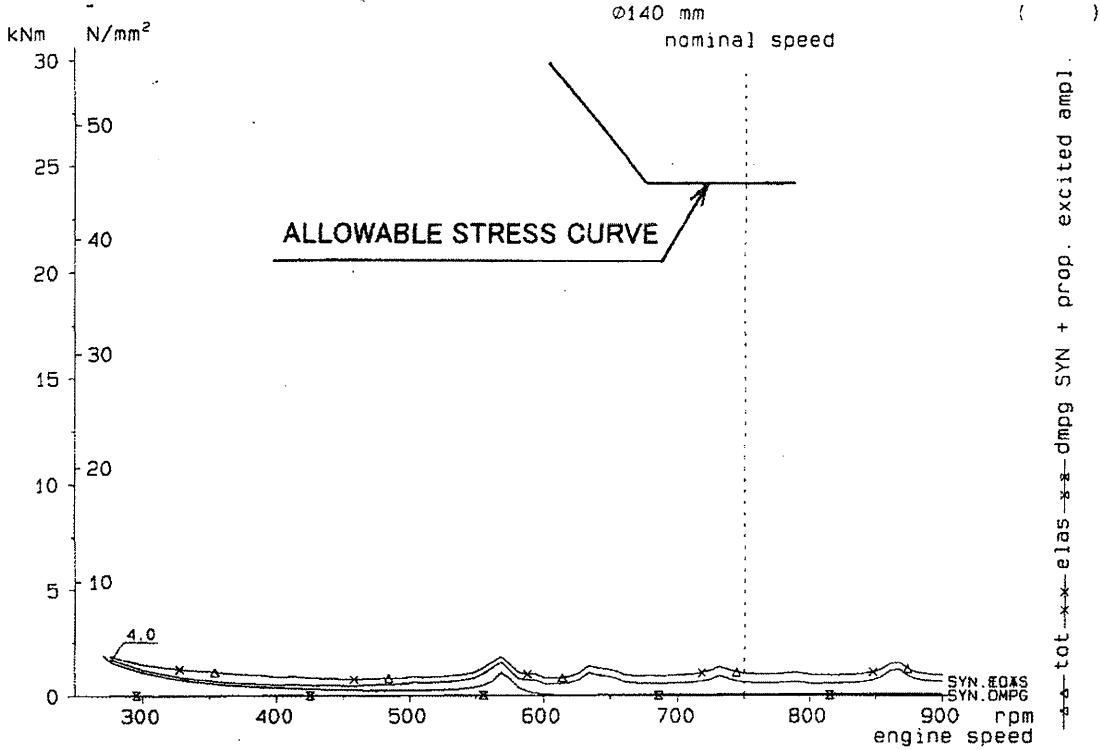
Engine : 8L28HX  
Normal firing

Propeller law up to 787.5 rpm

CN 0  
29-JAN-88  
V 7.0-01

## VIBRATORY TORQUE AND STRESS CLUTCH INPUT SHAFT

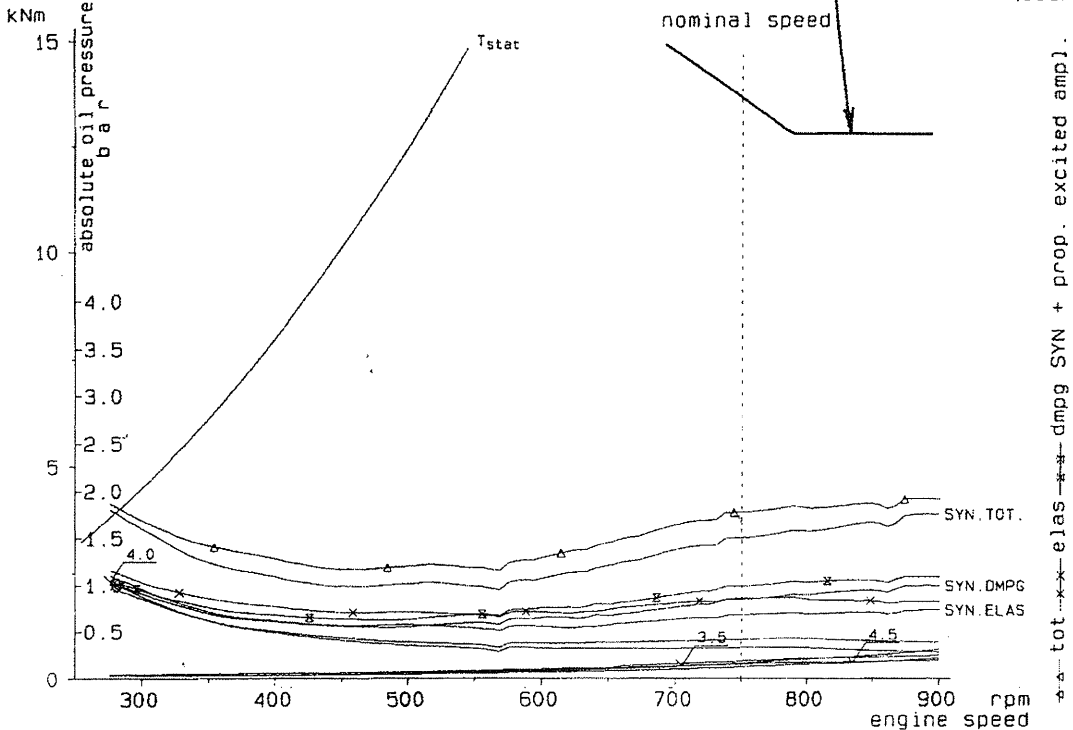
Between no.17 - 18



## PERMISSIBLE CONTINUOUS ELASTIC VIBRATORY TORQUE CURVE

VIBRATORY TORQUE GEISLINGER COUPLING BE72/15/140U-12

Between no.22 - 23  
(COUPL)



# FORWARD

2335M-0054 (13/42)

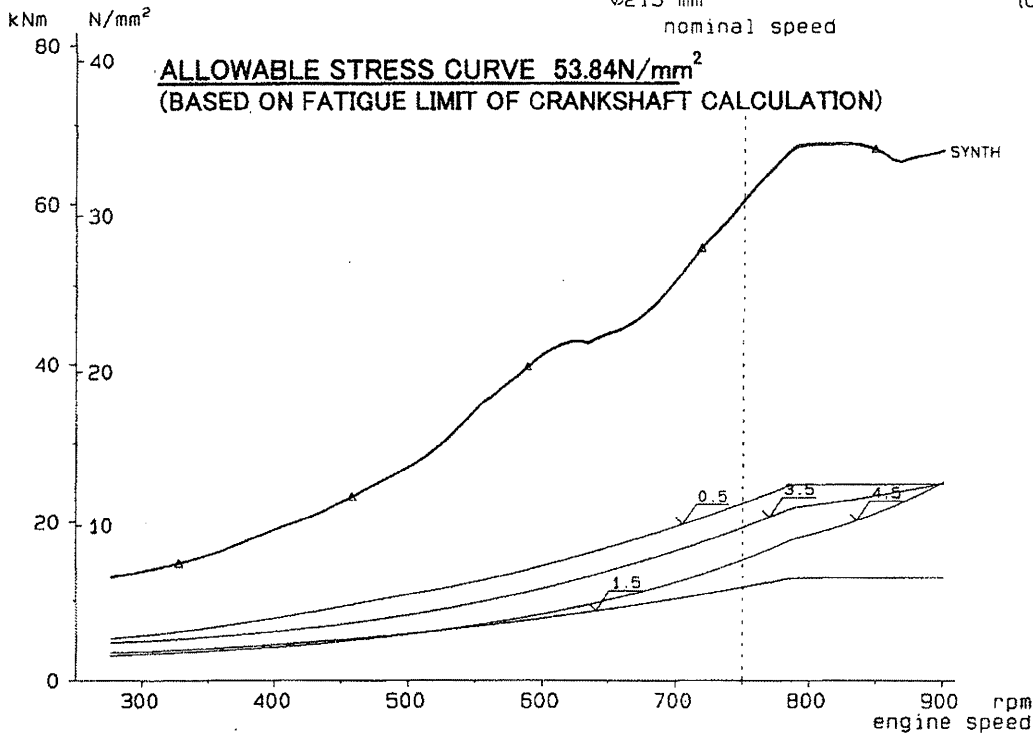
Engine : 8L28HX  
Normal firing

Propeller law up to 787.5 rpm

CN 0  
29-JAN-xx  
V 7.0-01

VIBRATORY TORQUE AND STRESS POSITION OF MAXIMUM STRESS

Between no.27 - 28  
(CRANK)



--- tot SYN + prop. excited ampl.

# FORWARD

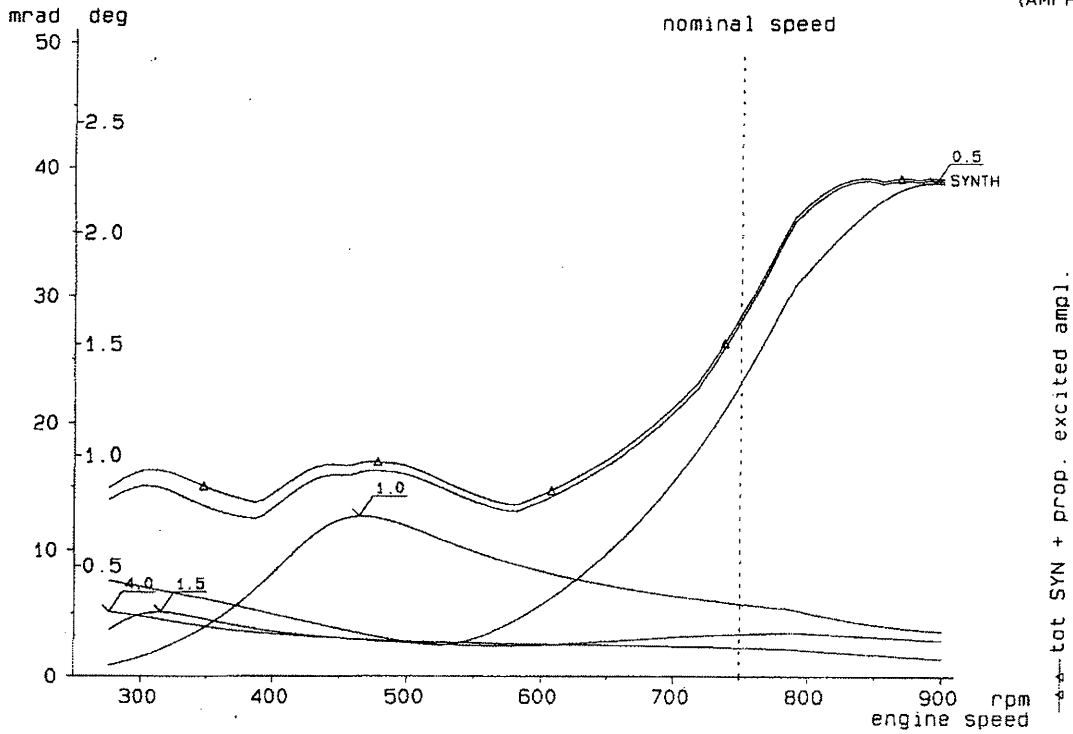
2335M-0054 (14/42)

Engine : 8L28HX Propeller law up to 787.5 rpm  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

CN 0  
29-JAN-\*\*  
V 7.0-01

VIBRATORY ANGLE AT FREE END

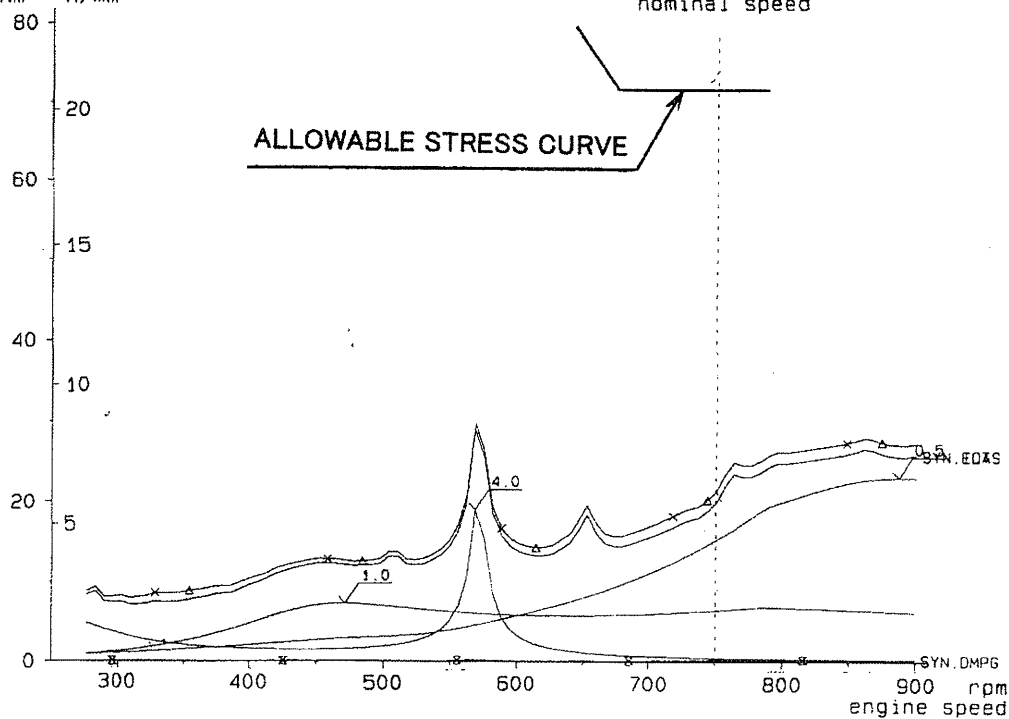
Inertia no. 33  
(AMFRE)



VIBRATORY TORQUE AND STRESS PROPELLER SHAFT  
Results referred to real speed 1 : 3.0990

Between no. 10 - 11  
(PROP)

Ø260 mm  
nominal speed



# FORWARD

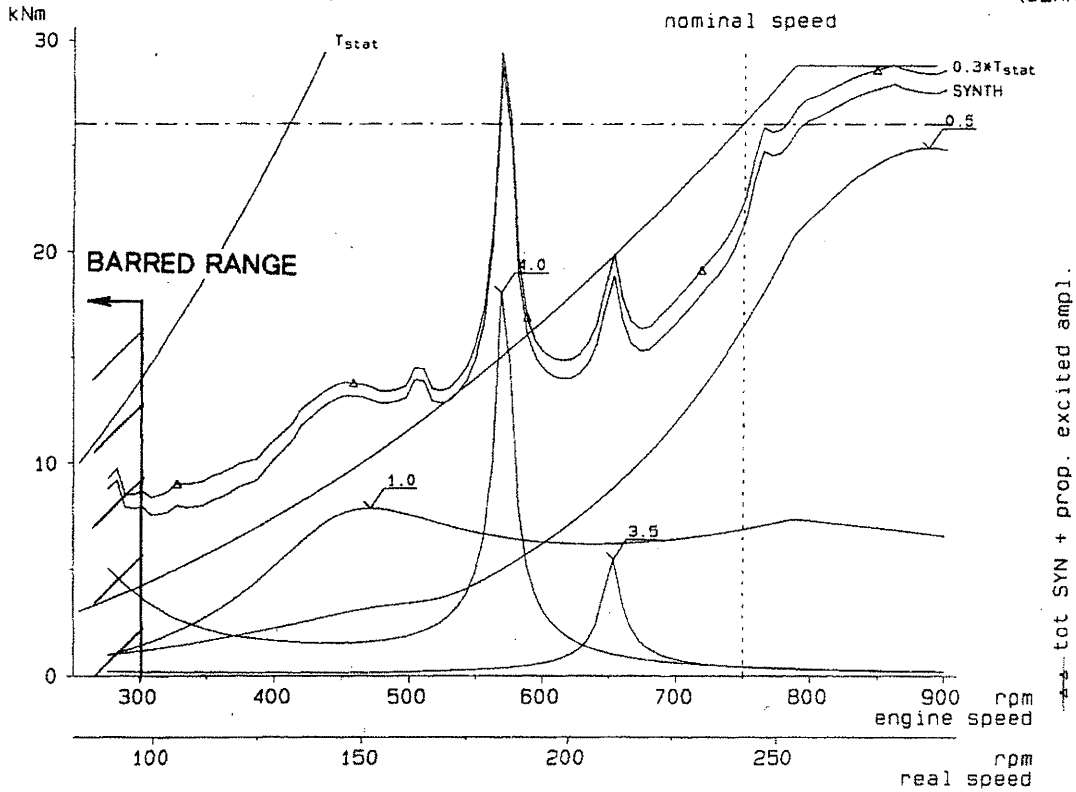
2335M-0054 (15/42)

Engine : 8L28HX Propeller law up to 787.5 rpm  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

CN 0  
29-JAN-xx  
V 7.0-01

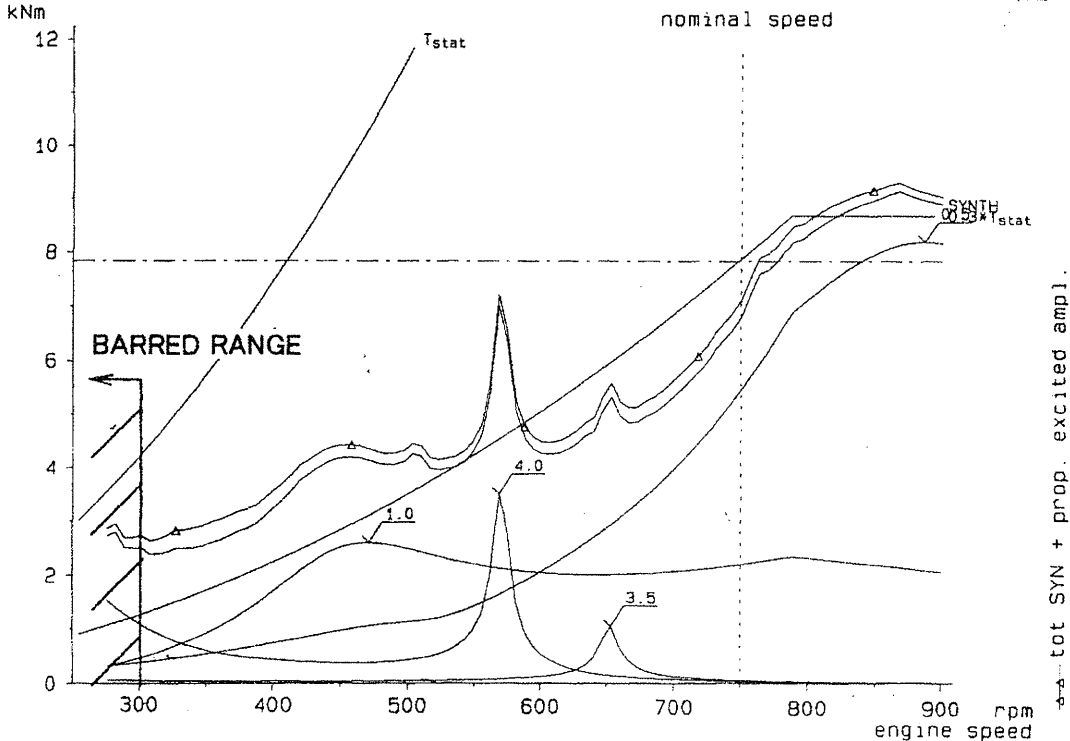
VIBRATORY TORQUE LOWER BEVELGEAR  
Results referred to real speed 1 : 3.0990

Between no.11 - 12  
(GEAR)



VIBRATORY TORQUE UPPER BEVELGEAR  
Results referred to real speed 1 : 0.9350

Between no.15 - 16  
(GEAR)



# FORWARD

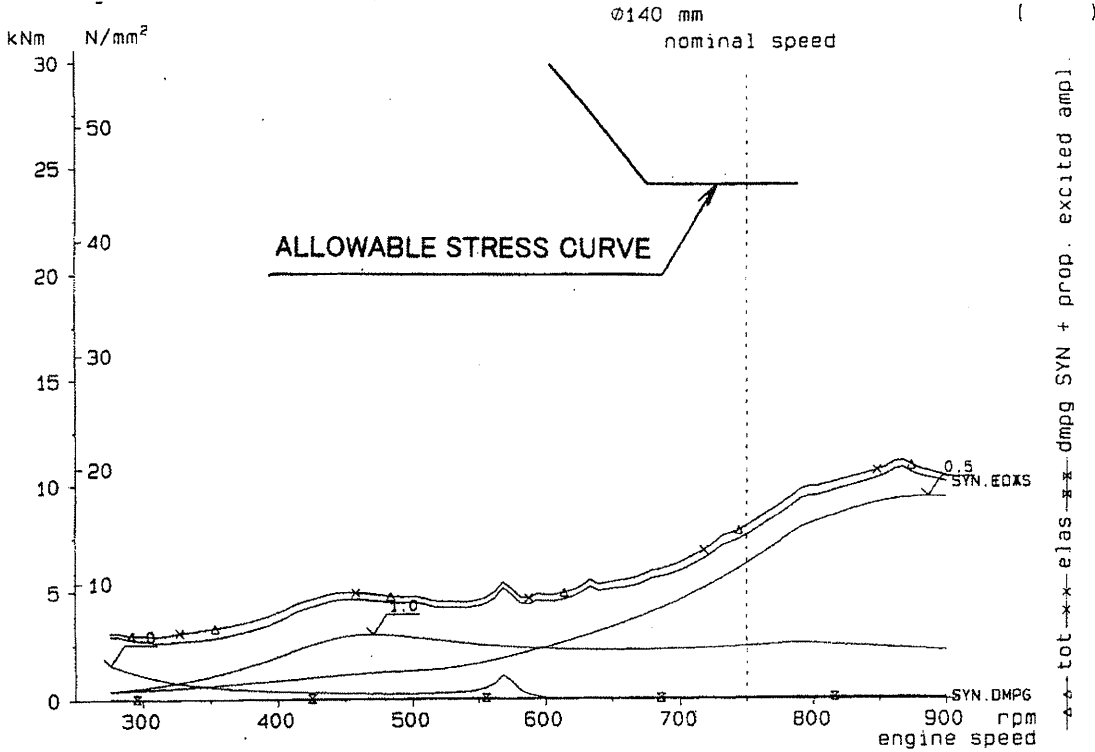
2335M-0054 (16/42)

Engine : 8L28HX Propellerlaw up to 787.5 rpm  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

CN 0  
29-JAN-88  
V 7.0-01

VIBRATORY TORQUE AND STRESS CLUTCH INPUTSHAFT

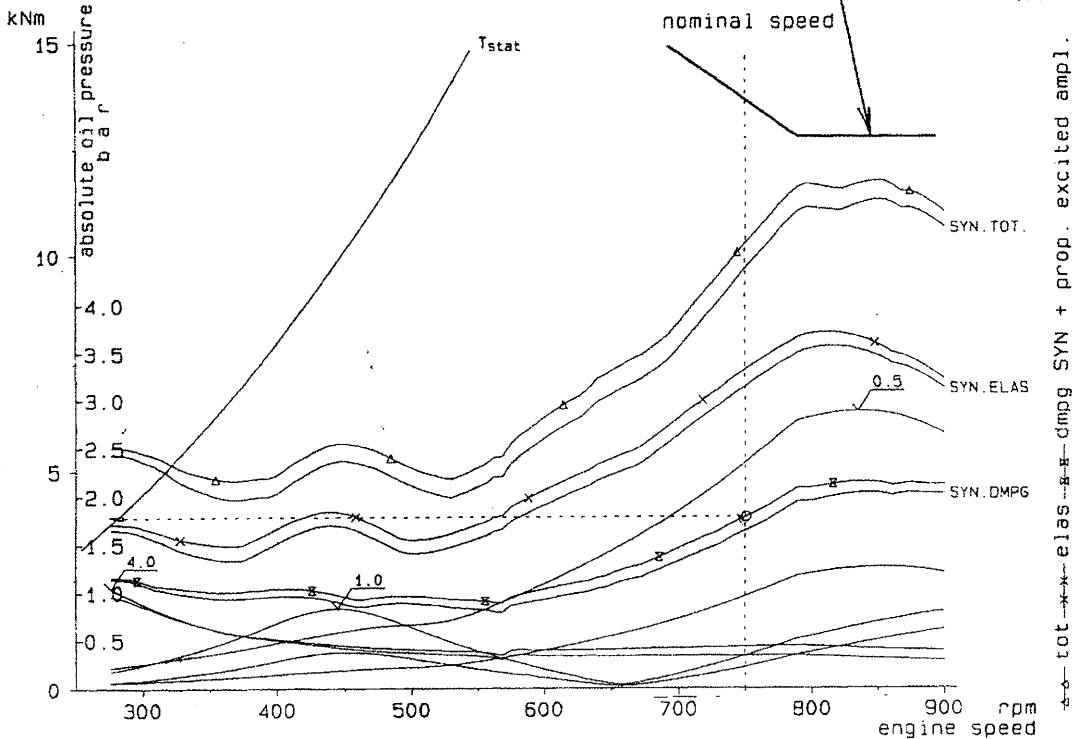
Between no.17 - 18



## PERMISSIBLE CONTINUOUS ELASTIC VIBRATORY TORQUE CURVE

VIBRATORY TORQUE GEISLINGER COUPLING BE72/15/140U-12

Between no.22 - 23  
(COUPL)





# FORWARD

2335M-0054 (17/42)

Engine : 8L28HX Propeller law up to 787.5 rpm  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

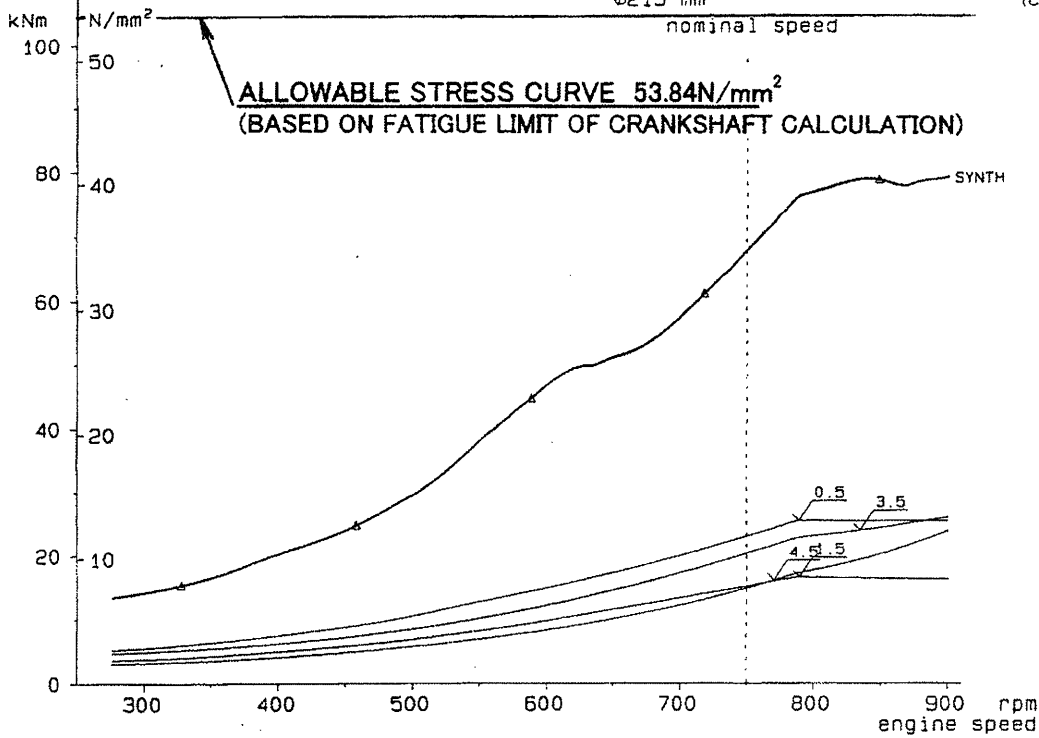
CN 0  
29-JAN-xx  
V 7.0-01

VIBRATORY TORQUE AND STRESS POSITION OF MAXIMUM STRESS

Between no.27 - 28

Ø215 mm

(CRANK)



# FORWARD and GENERATOR ON

2335M-0054 (18/42)

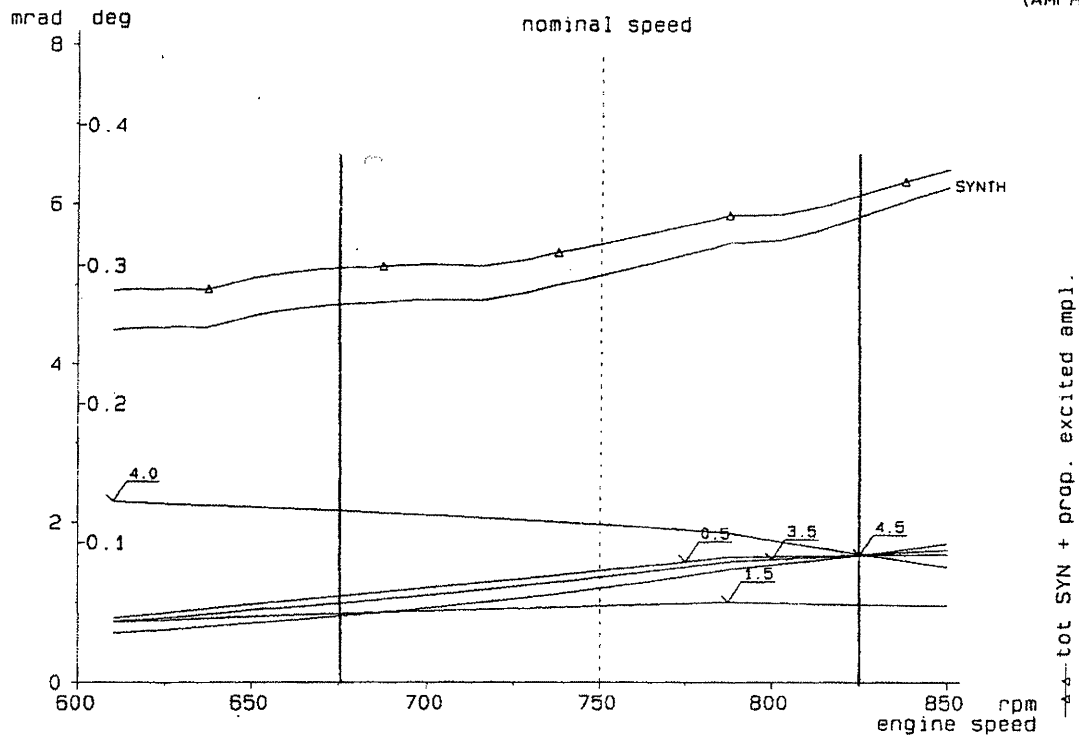
Engine : 8L28HX  
Normal firing

Propeller law up to 787.5 rpm

CN 0  
29-JAN-88  
V 7.0-01

VIBRATORY ANGLE AT FREE END

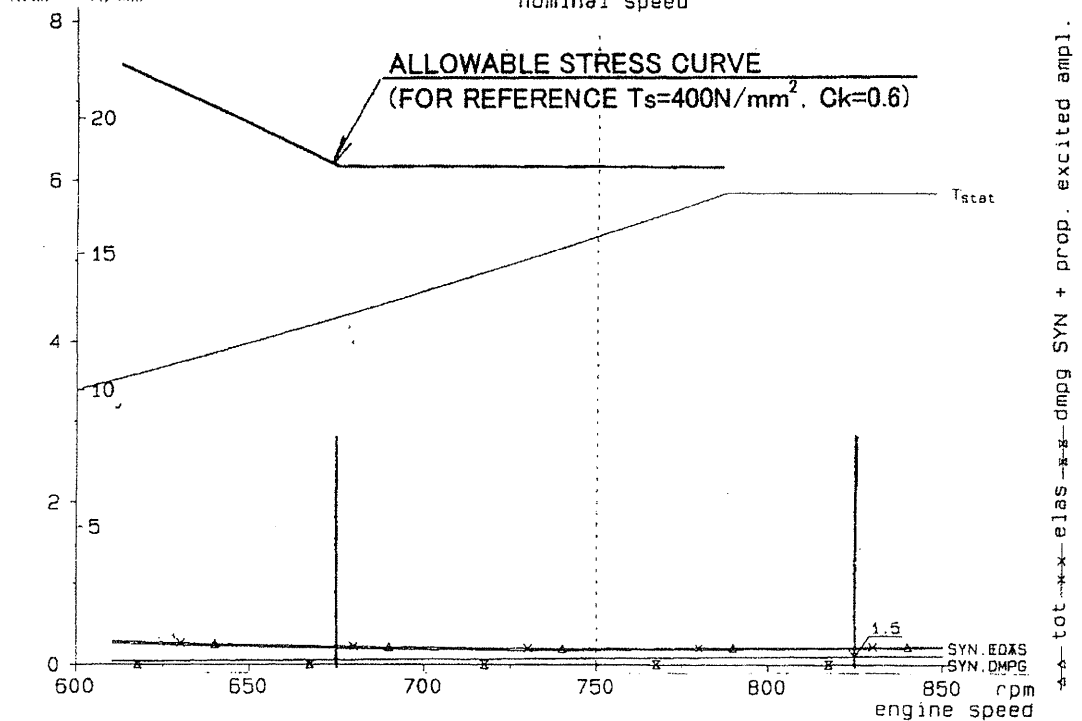
Inertia no.33  
(AMFRE)



## VIBRATORY TORQUE AND STRESS ROTOR SHAFT

Results referred to real speed 1 : 0.4167  $\phi 120$  mm  
nominal speed

Between no.1 - 2  
(ROTOR)



# FORWARD and GENERATOR ON

2335M-0054 (19/42)

Engine : 8L28HX  
Normal firing

Propeller law up to 787.5 rpm

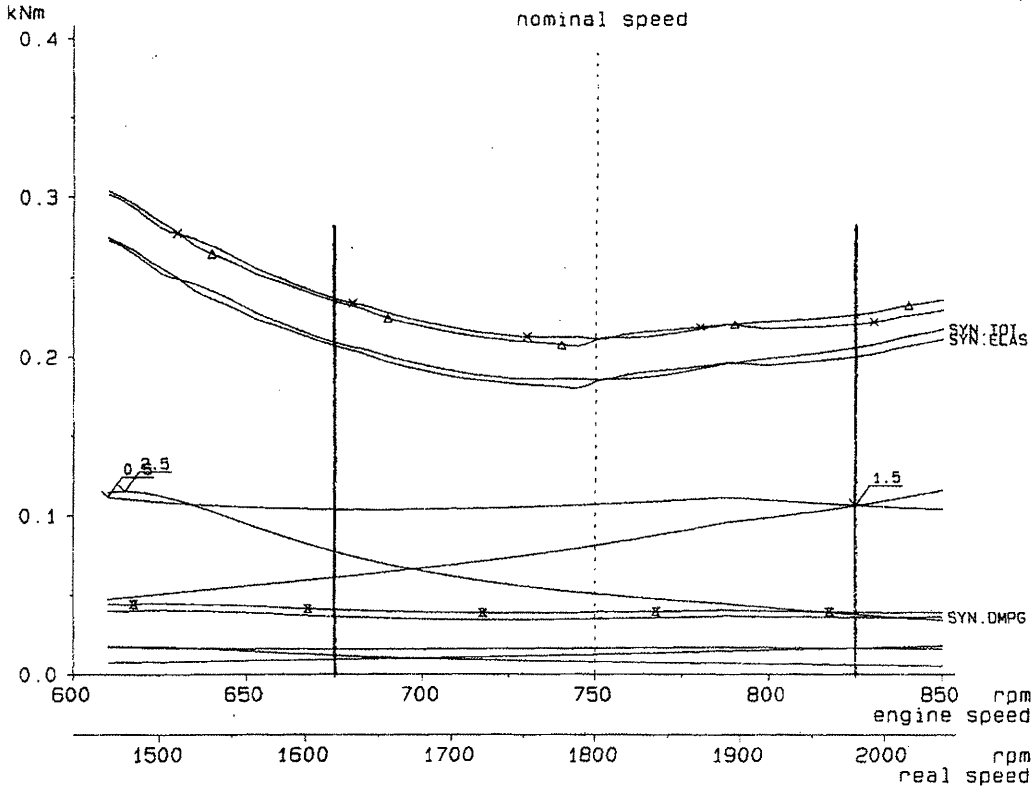
CN 0  
29-JAN-88  
V 7.0-01

VIBRATORY TORQUE COUPLING PVN54931W

Results referred to real speed 1 : 0.4167

Between no.2 - 3

( )

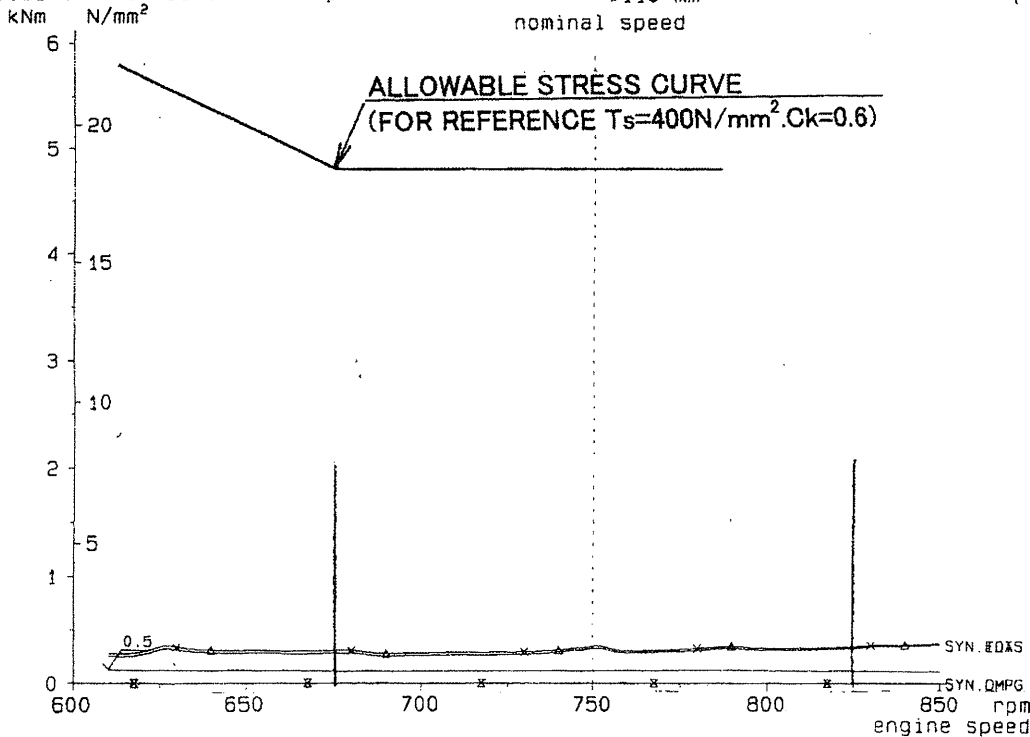


VIBRATORY TORQUE AND STRESS GEARBOX OUTPUTSHAFT

Results referred to real speed 1 : 0.4167  $\phi 110$  mm

Between no.3 - 4

( )



# FORWARD and GENERATOR ON

2335M-0054 (20/42)

Engine : 8L28HX  
Normal firing

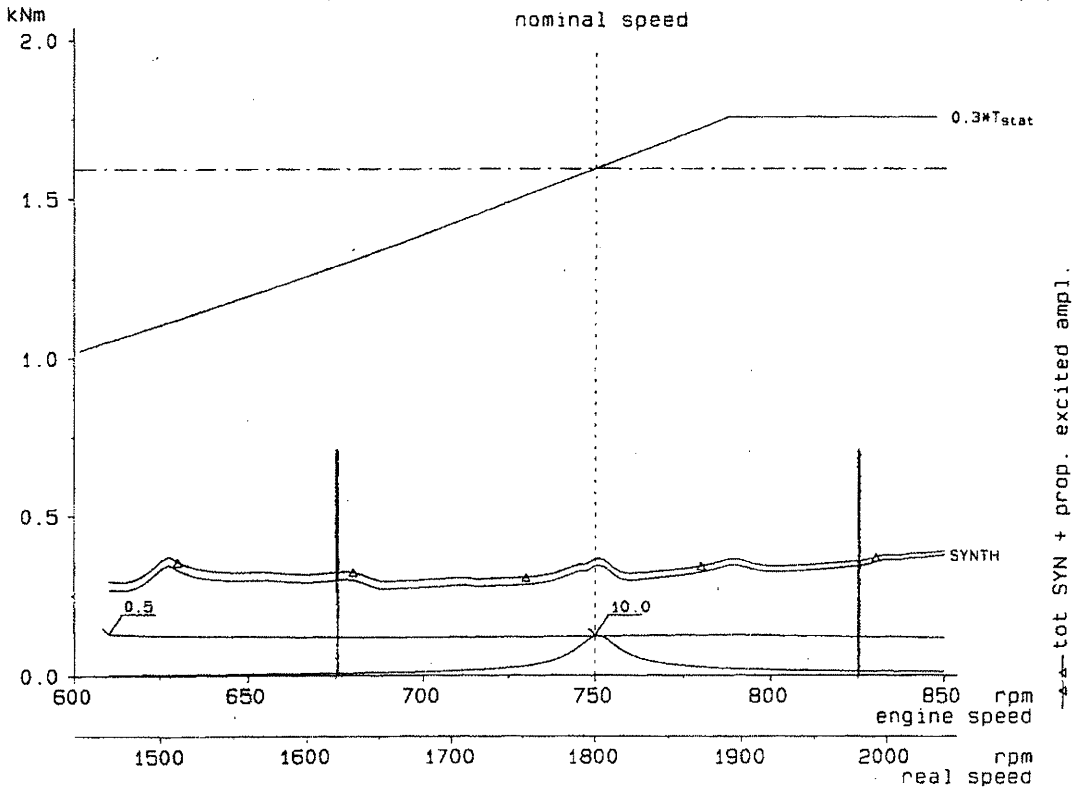
Propellerlaw up to 787.5 rpm

CN 0  
29-JAN-88  
V 7.0-01

## VIBRATORY TORQUE PTOGEAR

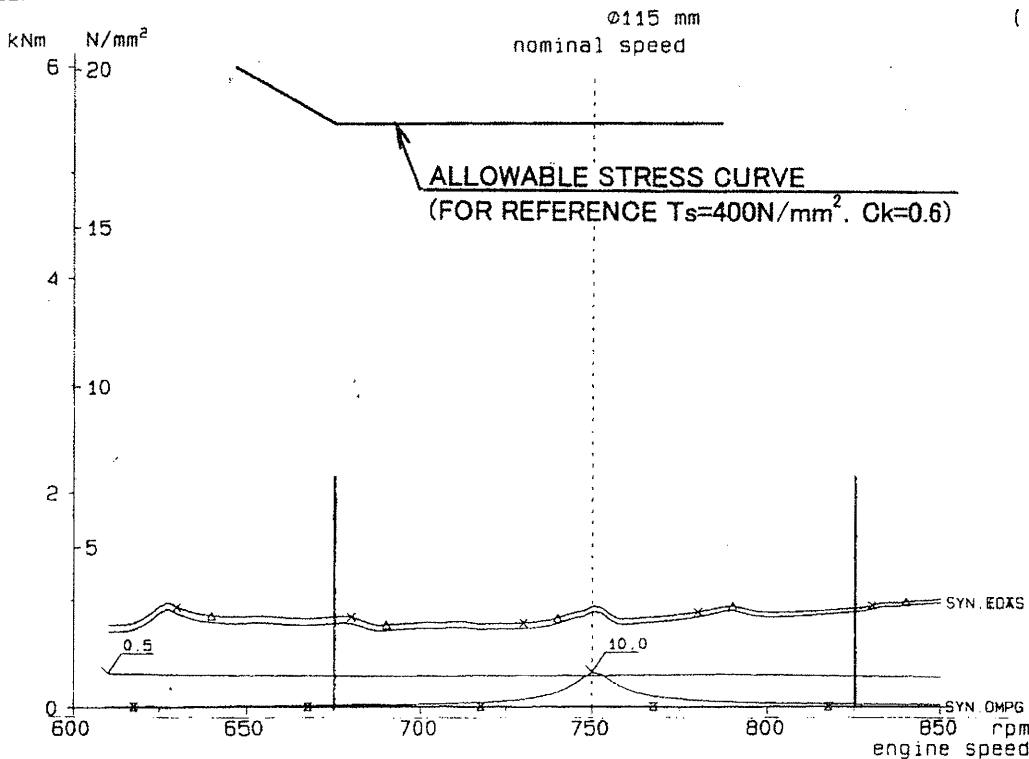
Results referred to real speed 1 : 0.4167

Between no.4 - 5  
(GEAR)



## VIBRATORY TORQUE AND STRESS GEARBOX INPUTSHAFT

Between no.5 - 6



# FORWARD and GENERATOR ON

2335M-0054 (21/42)

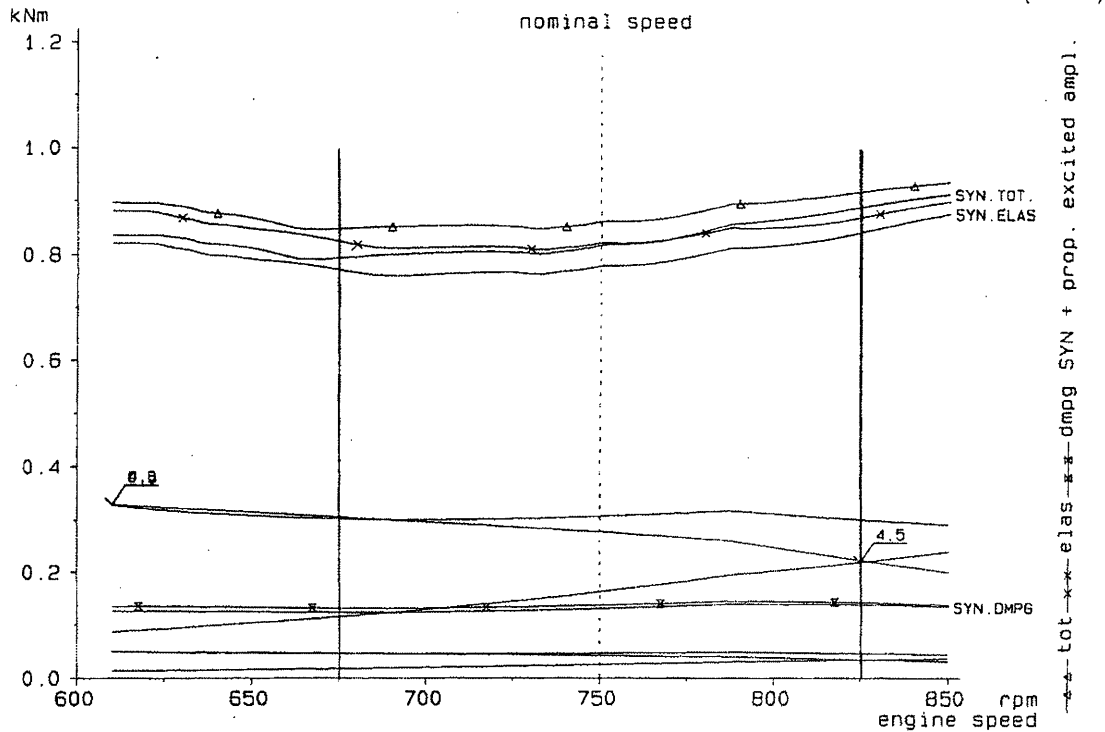
Engine : 8L28HX  
Normal firing

Propeller law up to 787.5 rpm

CN 0  
29-JAN-88  
V 7.0-01

VIBRATORY TORQUE COUPLING PVN66631W

Between no.6 - 7

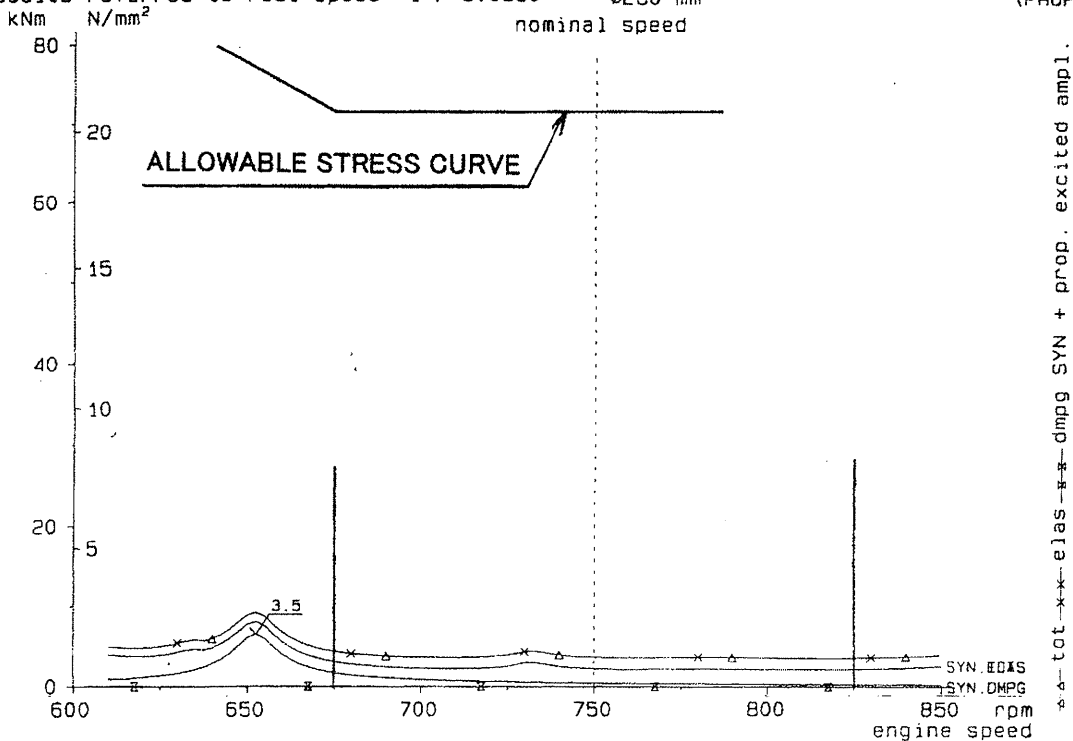


VIBRATORY TORQUE AND STRESS PROPELLER SHAFT

Results referred to real speed 1 : 3.0990 Ø260 mm

Between no.10 - 11

(PROP)



# FORWARD and GENERATOR ON

2335M-0054 (22/42)

Engine : BL28HX  
Normal firing

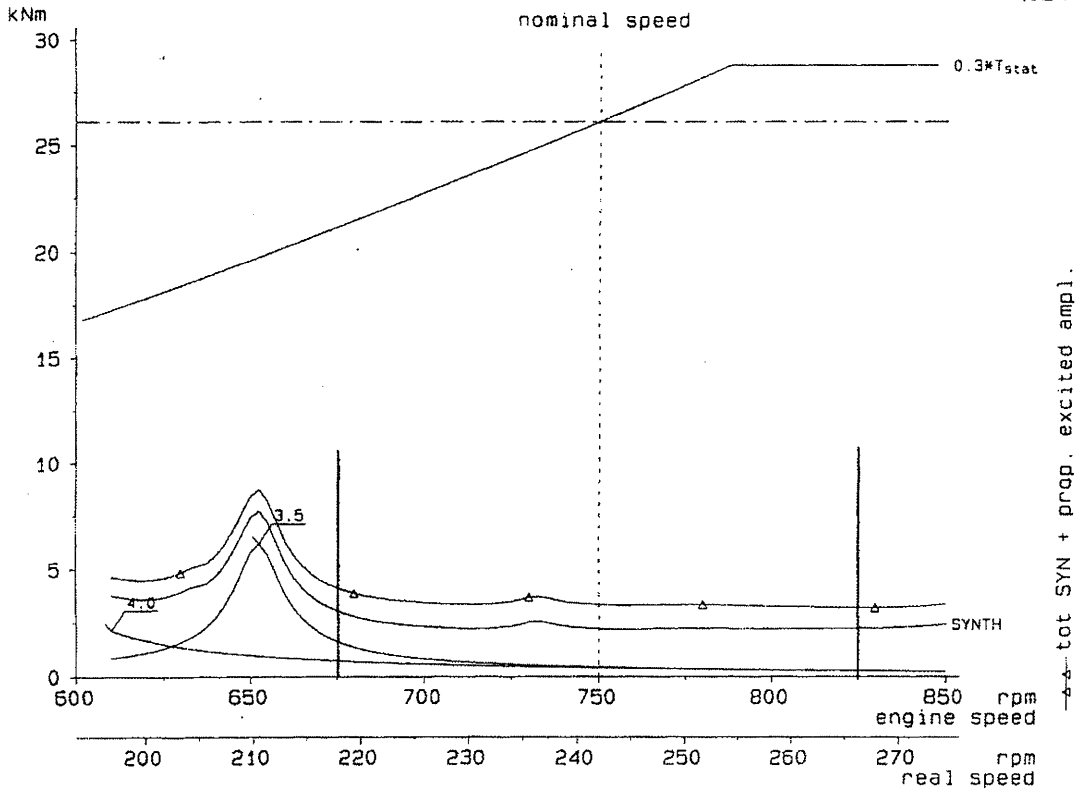
Propeller law up to 787.5 rpm

CN 0  
29-JAN-88  
V 7.0-01

## VIBRATORY TORQUE LOWER BEVELGEAR

Results referred to real speed 1 : 3.0990

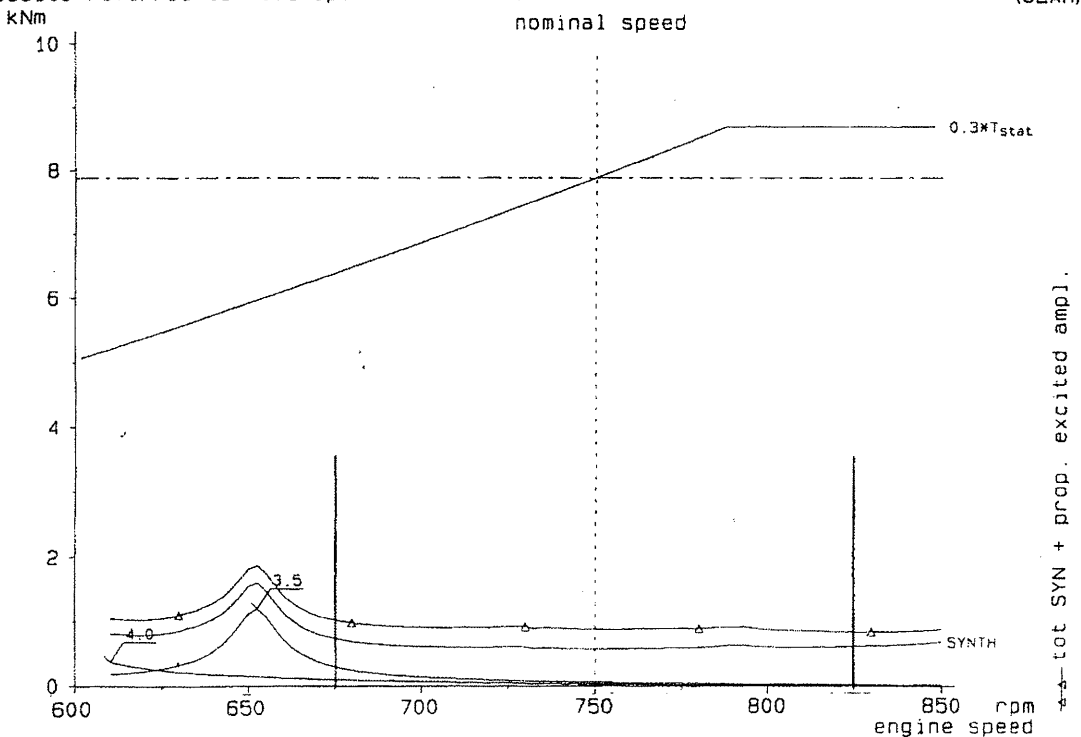
Between no.11 - 12  
(GEAR)



## VIBRATORY TORQUE UPPER BEVELGEAR

Results referred to real speed 1 : 0.9350

Between no.15 - 16  
(GEAR)



# FORWARD and GENERATOR ON

2335M-0054 (23/42)

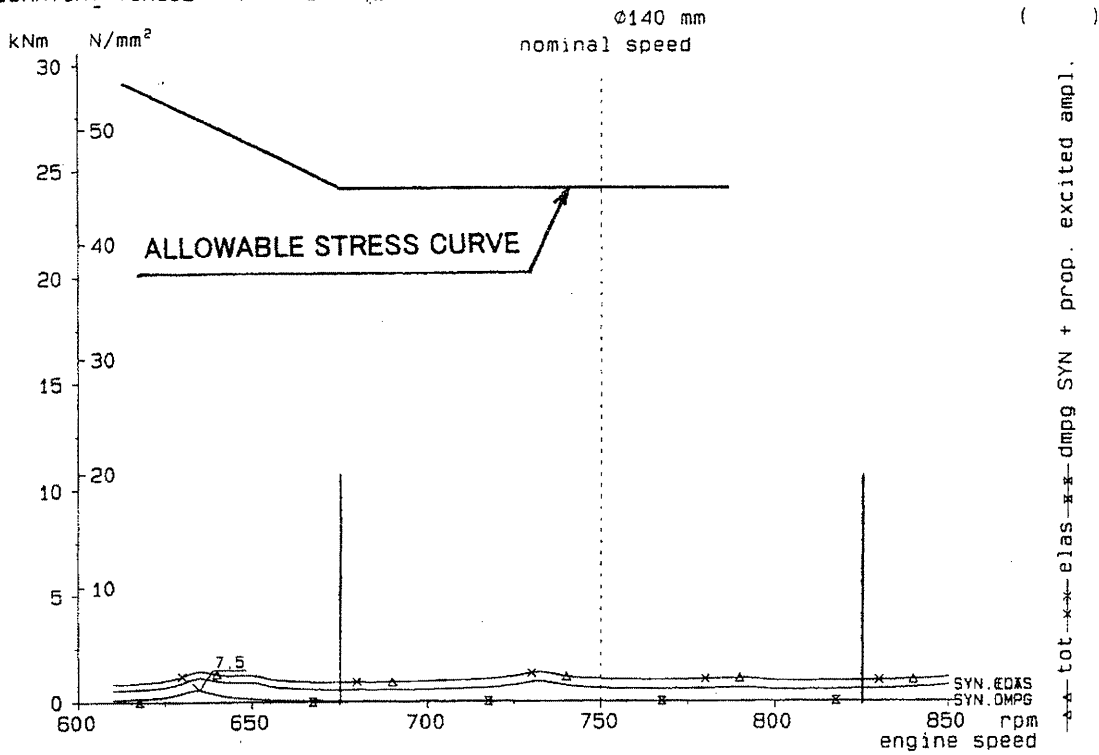
Engine : BL28HX  
Normal firing

Propeller law up to 787.5 rpm

CN 0  
29-JAN-88  
V 7.0-01

## VIBRATORY TORQUE AND STRESS CLUTCH INPUTSHAFT

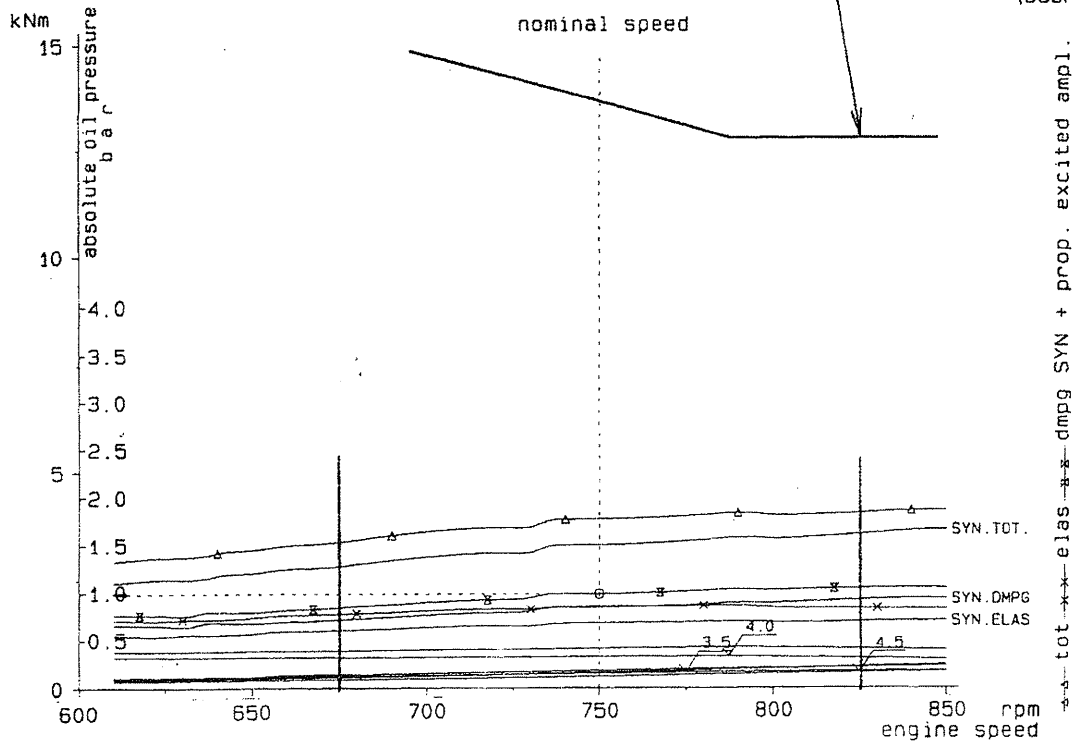
Between no.17 - 18



## PERMISSIBLE CONTINUOUS ELASTIC VIBRATORY TORQUE CURVE

VIBRATORY TORQUE GEISLINGER COUPLING BE72/15/140U-12

Between no.22 - 23  
(COUPL)



# FORWARD and GENERATOR ON

2335M-0054 (24/42)

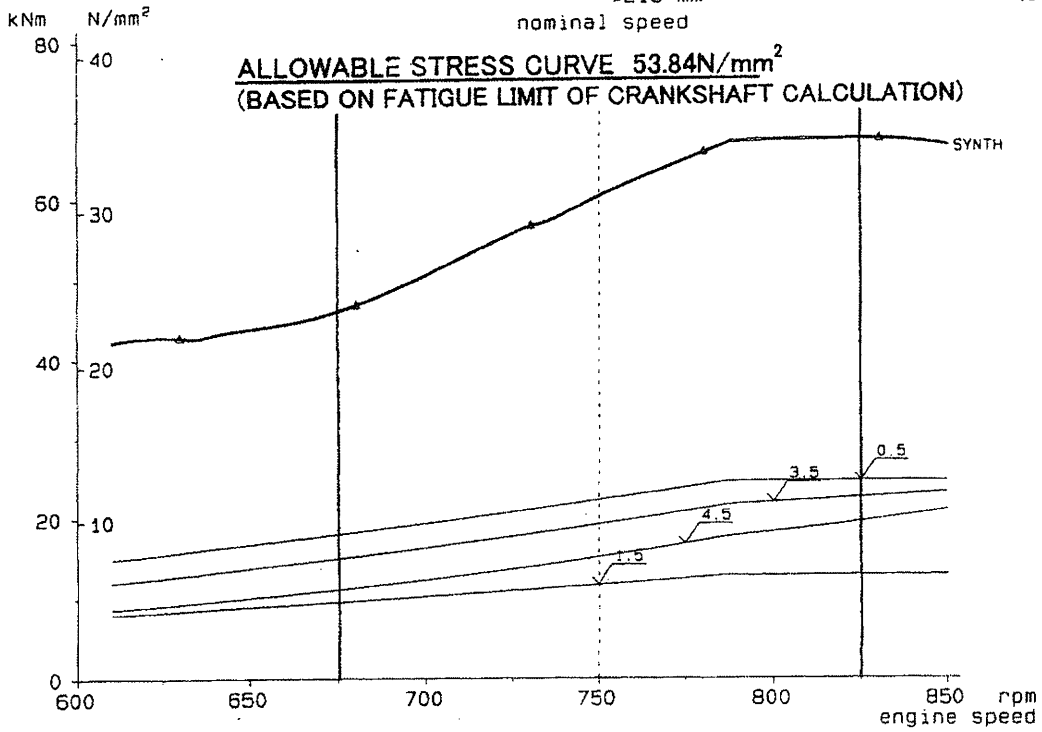
Engine : 8L28HX  
Normal firing

Propeller law up to 787.5 rpm

CN 0  
29-JAN-xx  
V 7.0-01

VIBRATORY TORQUE AND STRESS POSITION OF MAXIMUM STRESS  
nominal speed  
Ø215 mm

Between no.27 - 28  
(CRANK)





# FORWARD and GENERATOR ON

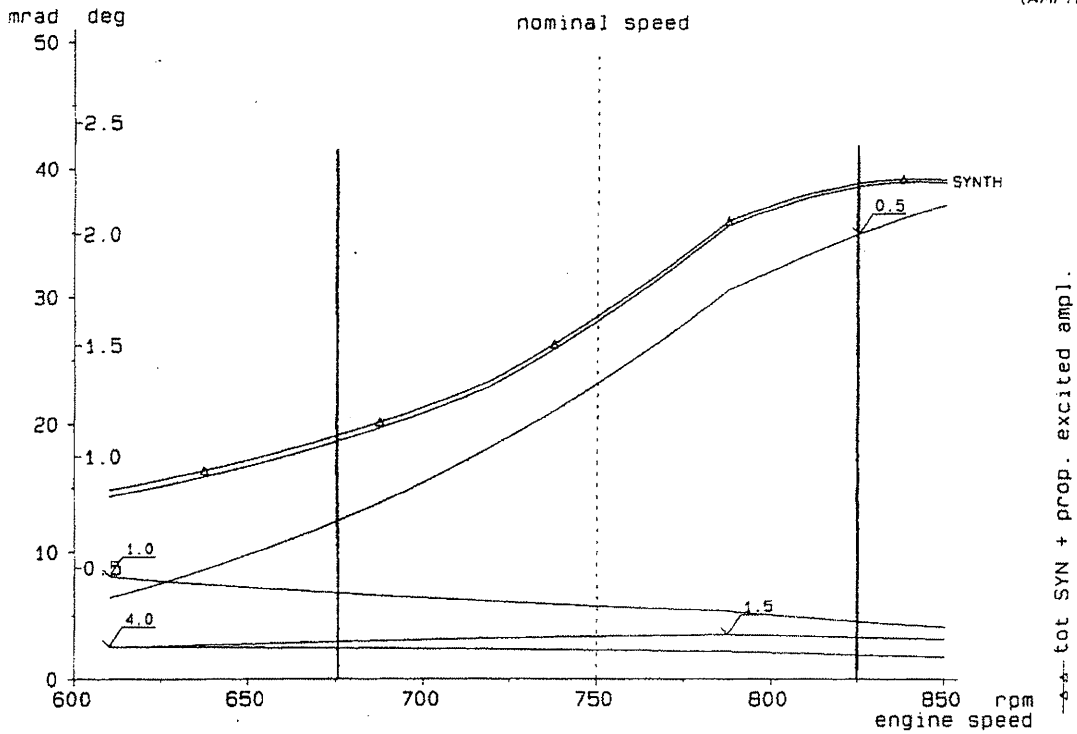
2335M-0054 (25/42)

Engine : 8L28HX Propeller law up to 787.5 rpm  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

CN 0  
29-JAN-\*\*  
V 7.0-01

VIBRATORY ANGLE AT FREE END

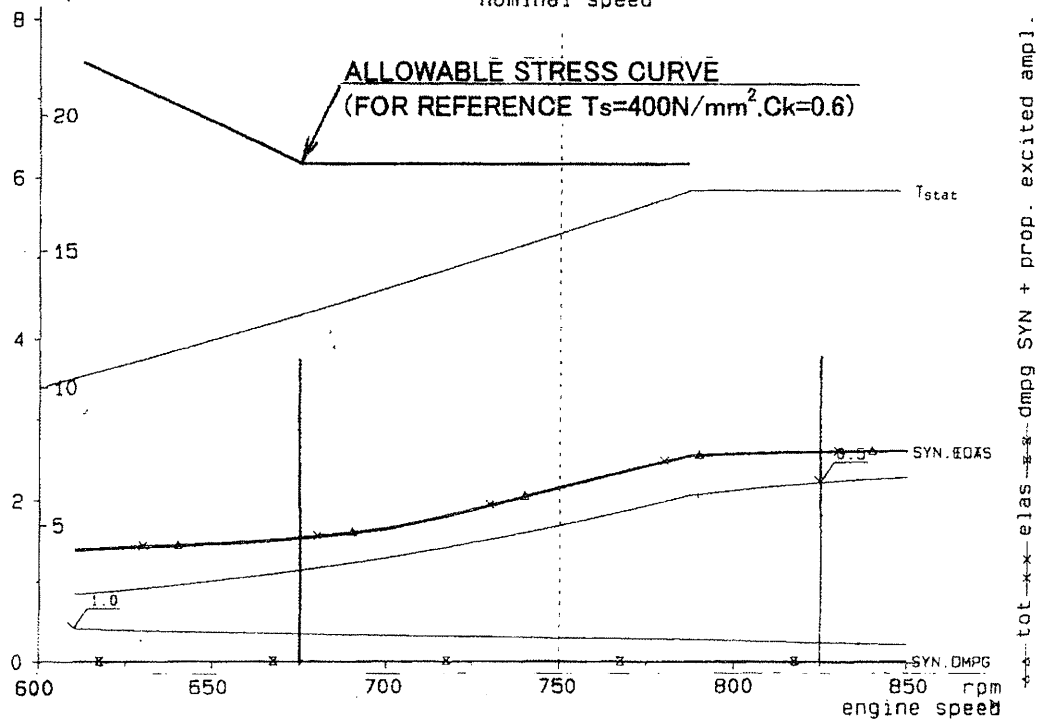
Inertia no.33  
(AMFRE)



## VIBRATORY TORQUE AND STRESS ROTOR SHAFT

Results referred to real speed 1 : 0.4167  $\phi 120$  mm  
nominal speed

Between no.1 - 2  
(ROTOR)



# FORWARD and GENERATOR ON

2335M-0054 (26/42)

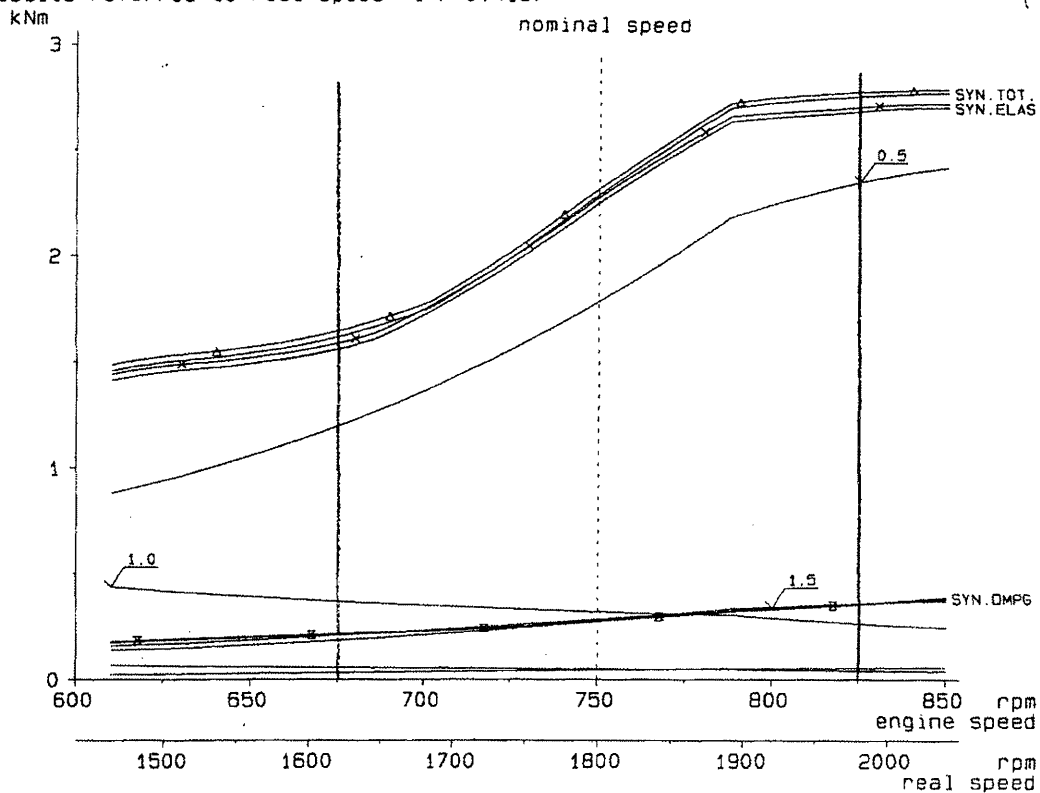
Engine : 8L28HX Propeller law up to 787.5 rpm  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

CN 0  
29-JAN-xx  
V 7.0-01

## VIBRATORY TORQUE COUPLING PVN54931W

Results referred to real speed 1 : 0.4167

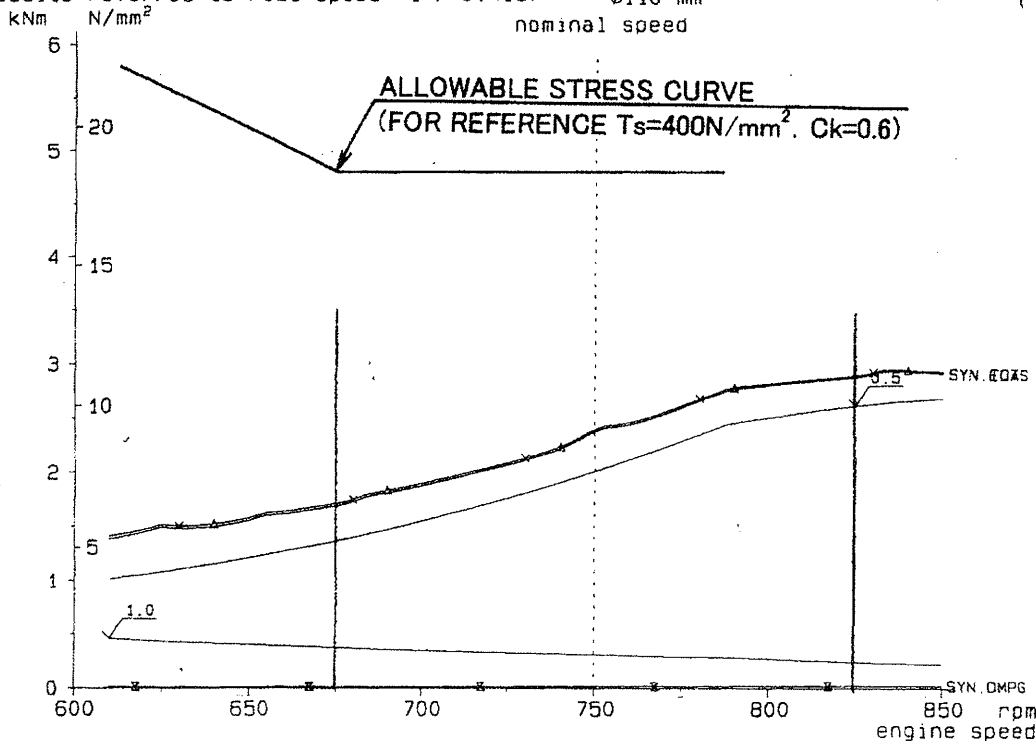
Between no.2 - 3



## VIBRATORY TORQUE AND STRESS GEARBOX OUTPUTSHAFT

Results referred to real speed 1 : 0.4167  $\phi 110$  mm

Between no.3 - 4



# FORWARD and GENERATOR ON

2335M-0054 (27/42)

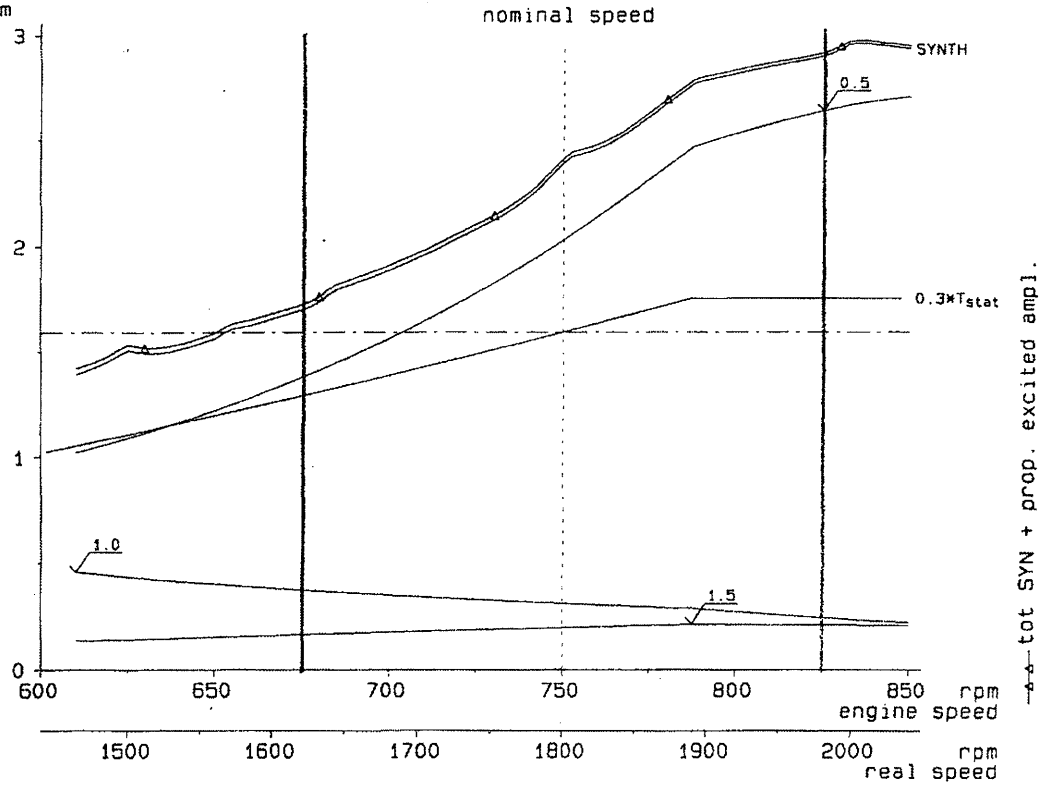
Engine : BL28HX Propeller law up to 787.5 rpm  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

CN 0  
29-JAN-xx  
V 7.0-01

## VIBRATORY TORQUE PTOGEAR

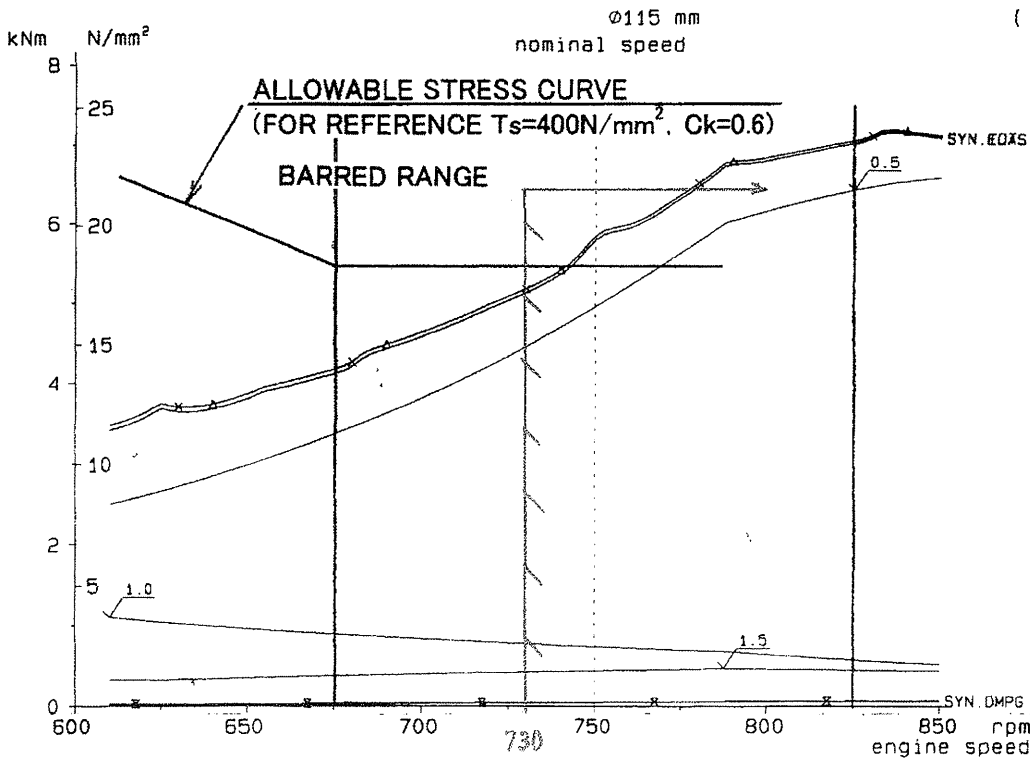
Results referred to real speed 1 : 0.4167

Between no.4 - 5  
(GEAR)



## VIBRATORY TORQUE AND STRESS GEARBOX INPUTSHAFT

Between no.5 - 6  
( )



# FORWARD and GENERATOR ON

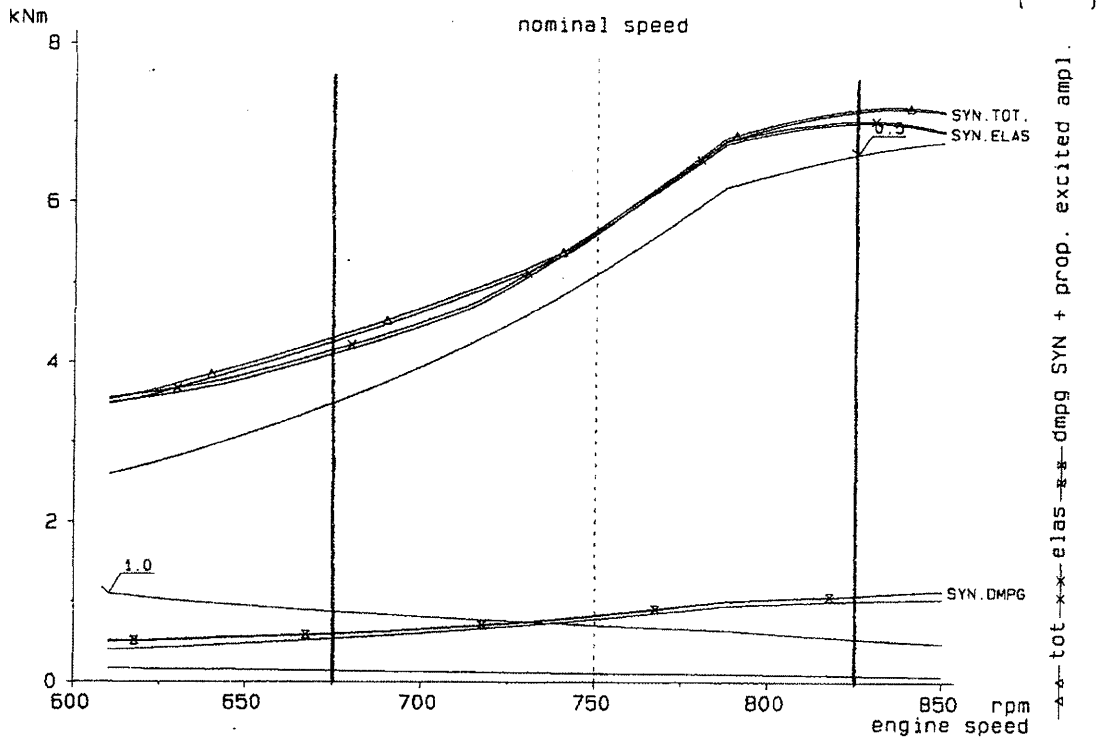
2335M-0054 (28/42)

Engine : 8L28HX Propeller law up to 787.5 rpm  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

CN 0  
29-JAN-xx  
V 7.0-01

VIBRATORY TORQUE COUPLING PVN66631W

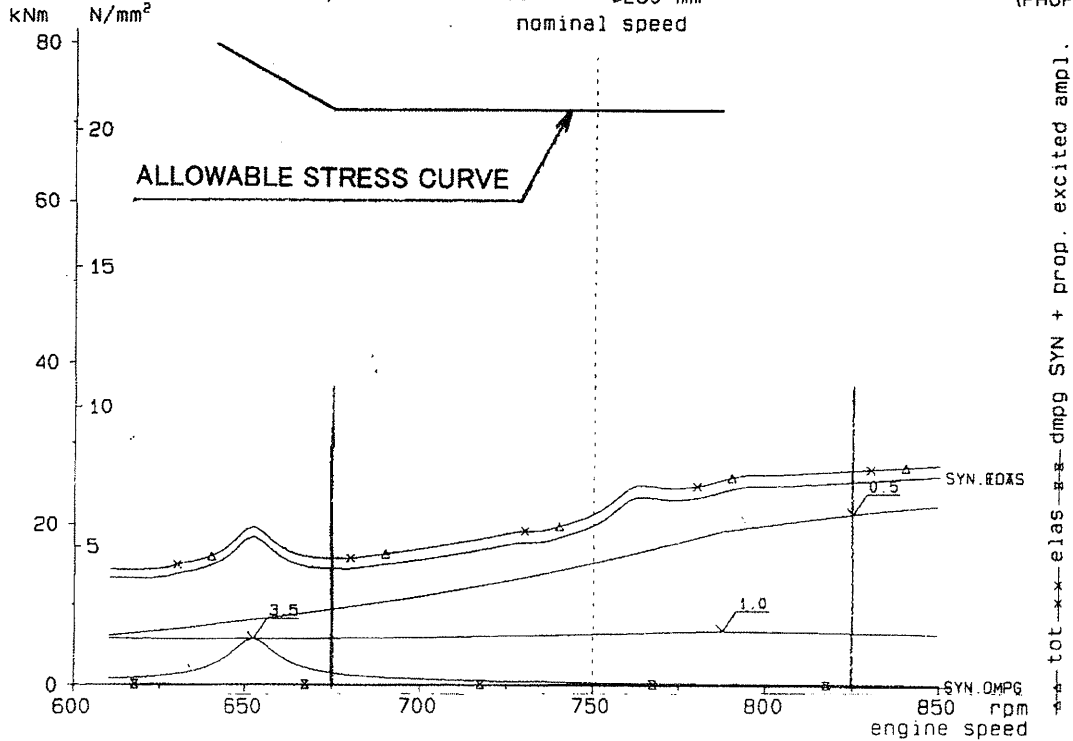
Between no.6 - 7



## VIBRATORY TORQUE AND STRESS PROPELLER SHAFT

Results referred to real speed 1 : 3.0990 Ø260 mm

Between no.10 - 11 (PROP)



# FORWARD and GENERATOR ON

2335M-0054 (29/42)

Engine : 8L28HX Propeller law up to 787.5 rpm  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

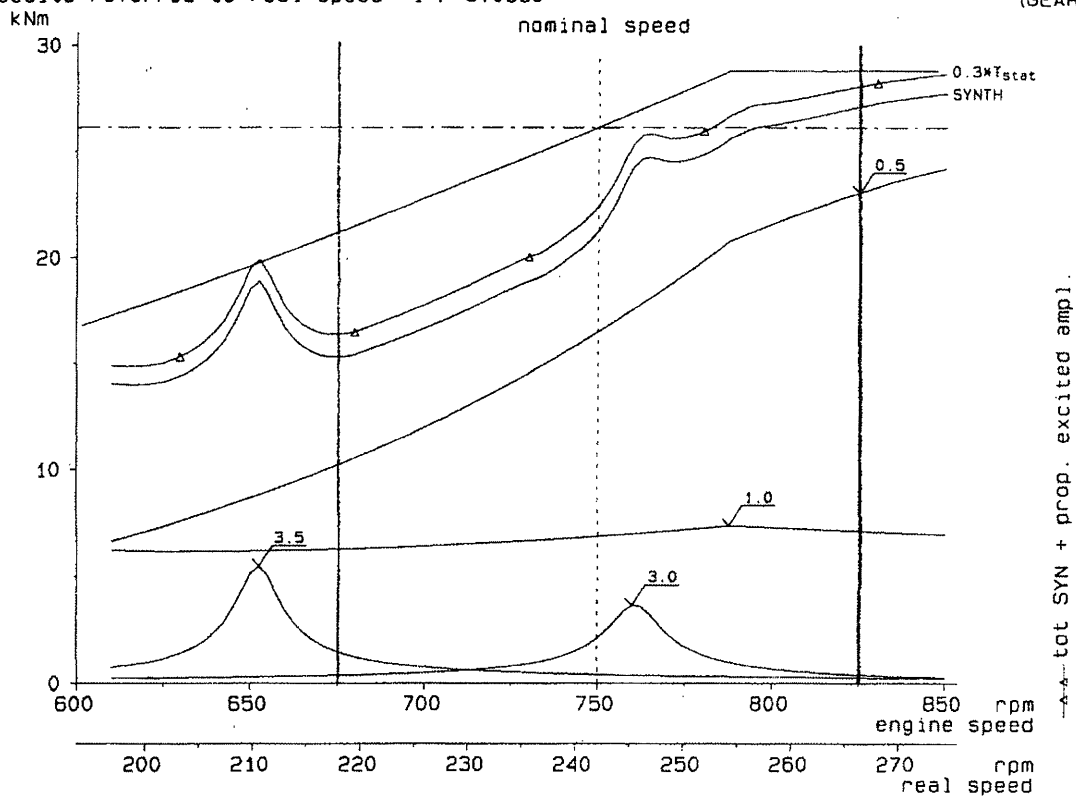
CN 0  
29-JAN-\*\*  
V 7.0-01

## VIBRATORY TORQUE LOWER BEVELGEAR

Results referred to real speed 1 : 3.0990

Between no.11 - 12

(GEAR)

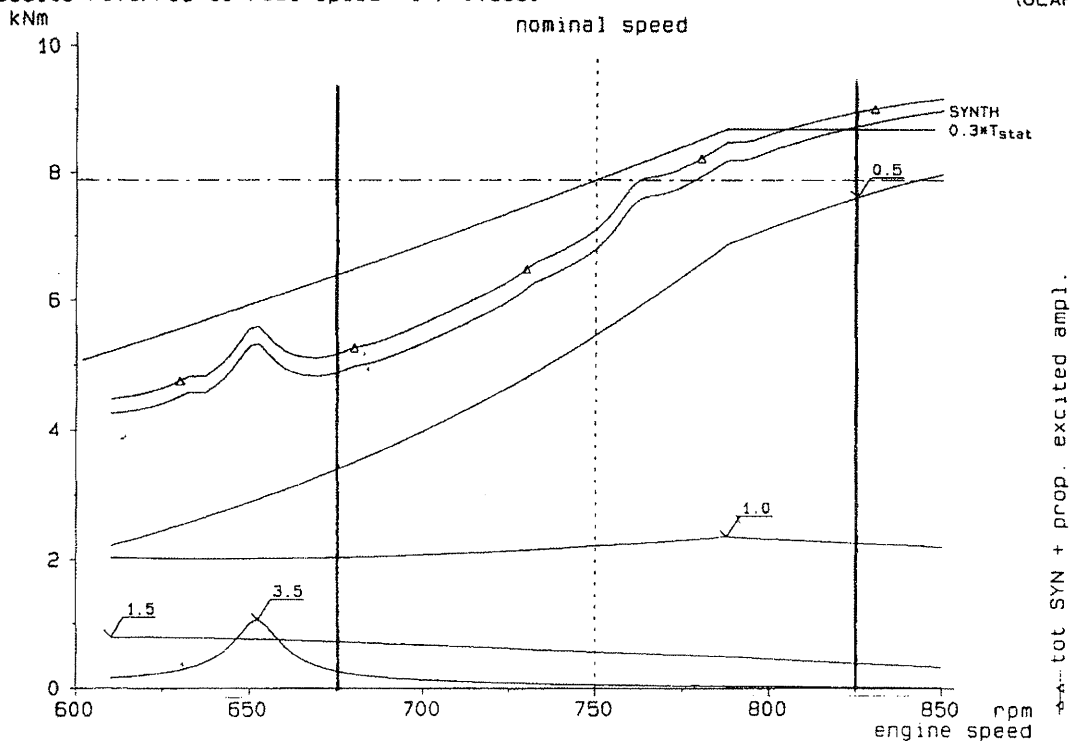


## VIBRATORY TORQUE UPPER BEVELGEAR

Results referred to real speed 1 : 0.9350

Between no.15 - 16

(GEAR)



# FORWARD and GENERATOR ON

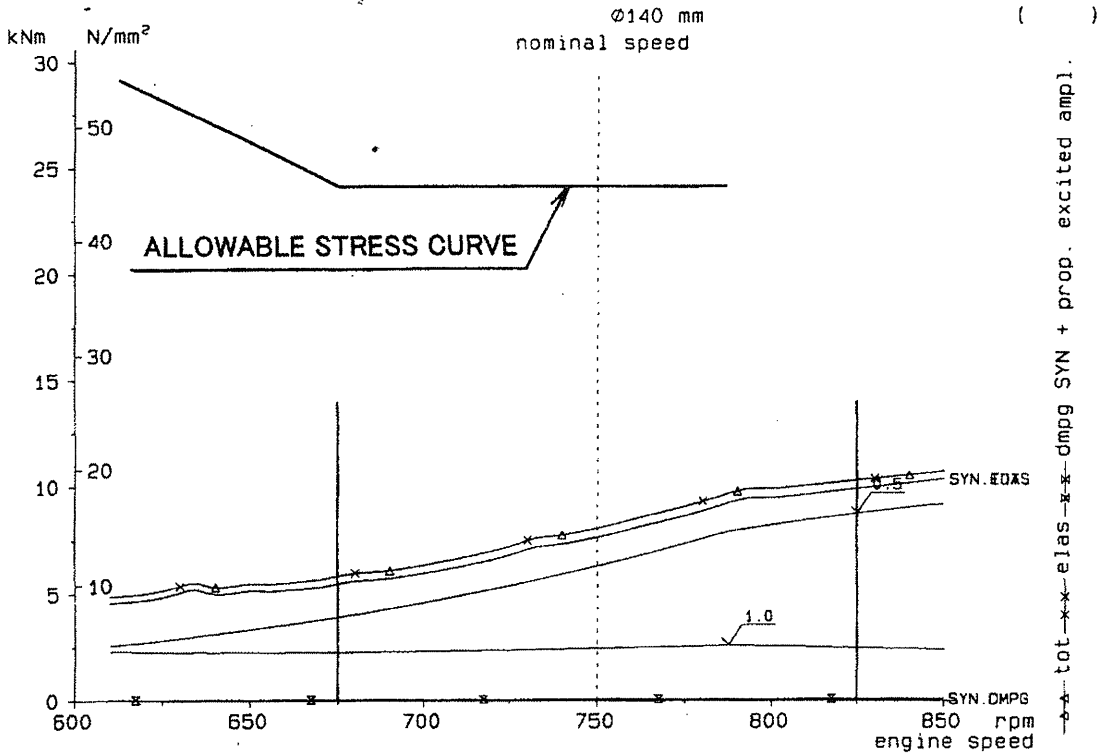
2335M-0054 (30/42)

Engine : 8L28HX Propellerlaw up to 787.5 rpm  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

CN 0  
29-JAN-\*\*  
V 7.0-01

## VIBRATORY TORQUE AND STRESS CLUTCH INPUTSHAFT

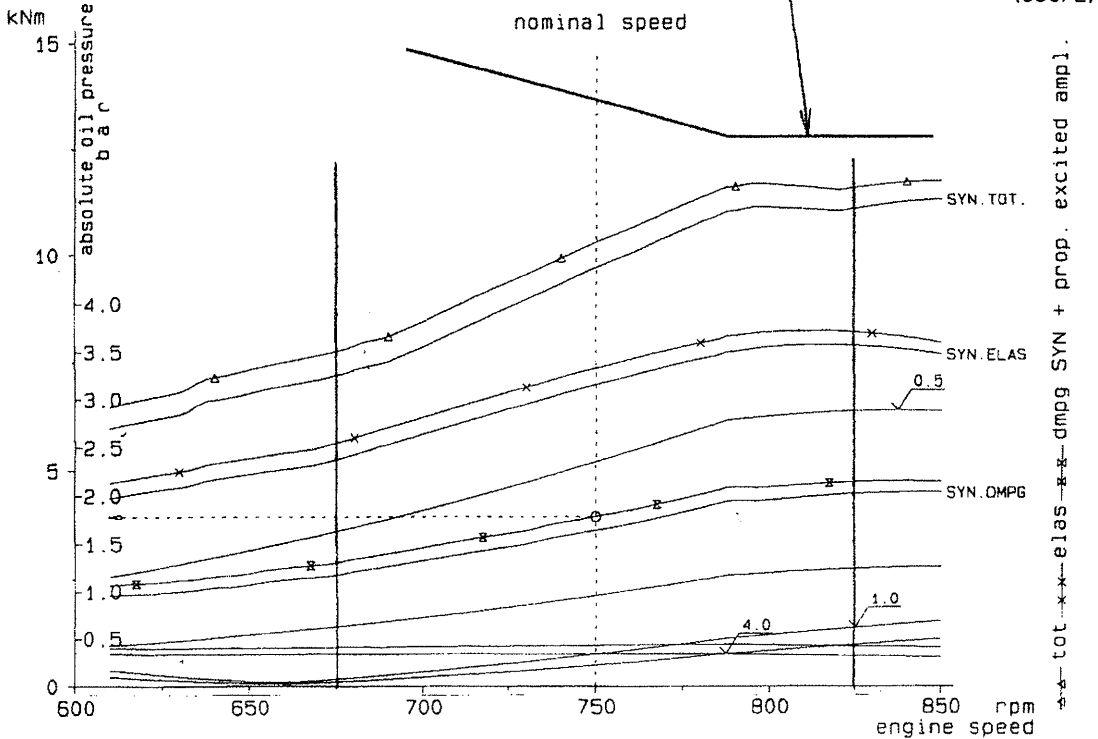
Between no.17 - 18



## PERMISSIBLE CONTINUOUS ELASTIC VIBRATORY TORQUE CURVE

VIBRATORY TORQUE GEISLINGER COUPLING BE72/15/140U-12

Between no.22 - 23  
(COUPL)



# FORWARD and GENERATOR ON

2335M-0054 (31/42)

Engine : 8L28HX

Propellerlaw up to 787.5 rpm

CN 0

Misfiring cyl. 8 according compression

29-JAN-xx

BMEP of the firing cylinders 14.3 % uprated

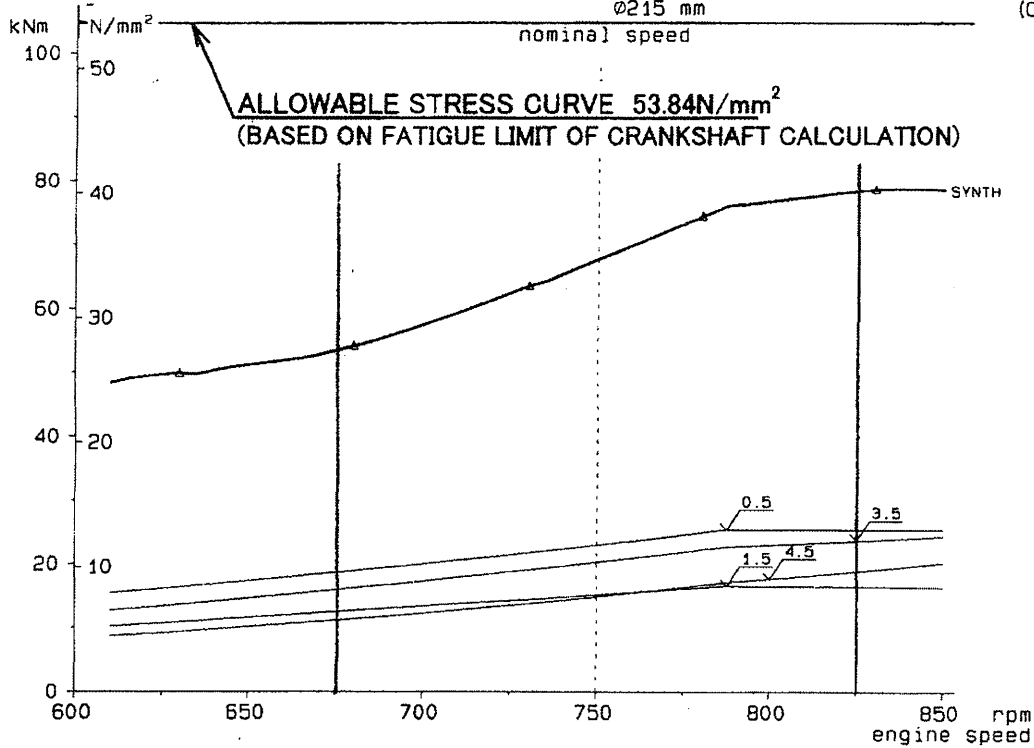
V 7.0-01

VIBRATORY TORQUE AND STRESS POSITION OF MAXIMUM STRESS

Between no.27 - 28

Ø215 mm

(CRANK)



— TABLE OF MASS MOMENT OF INERTIA &amp; TORSIONAL STIFFNESS —

## GENERATOR ON

NO.	NAME	MASS MOMENT OF INERTIA [kg·m <sup>2</sup> ]	TORSIONAL STIFFNESS [MN·m/rad]	MINIMUM DIAMETER [mm]	MATERIAL	TENSILE STRENGTH [N/mm <sup>2</sup> ]	SHAFT TYPE	REDUCTION RATIO
1	ROTOR	19.10	4.794	120.0	*	*	KEY WAY	0.4167
2	STM.C.	1.162	0.1015					0.4167
3	STM.C.	3.422	4.32	110.0	*	*	KEY WAY	0.4167
4	PTOGEAR	0.259	INFINITE					0.4167
5	PTOGEAR	3.180	4.44	115.0	*	*	KEY WAY	1.000
6	STM.C.	8.9845	0.1348					1.000
7	STM.C.	4.7585	42.856	170.0	*	*	INTERMEDIATE	1.000
8	FLANGE	1.429	INFINITE					1.000
	→ connect to No. 26							
10	CLUTCH	7.520	11.6	140.0	S45C	680.0	SHRINK FIT	1.000
11	FLANGE+UNIV. J.	5.345	5.34					1.000
12	UNIV. J. + FLANGE	5.31	0.323	139.0	SF590A	590.0	SHRINK FIT	1.000
13	FLANGE+UNIV. J.	5.31	5.34					1.000
14	UNIV. J. + FLANGE	5.51	2.191	139.0	SF590A	590.0	SHRINK FIT	1.000
15	FLANGE+G. L. C.	56.86	0.266					1.000
16	FLYWHEEL+G. L. C.	33.23	57.35	215.0	CrMo STEEL	780.0	CRANK	1.000
17	NO. 1 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
18	NO. 2 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
19	NO. 3 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
20	NO. 4 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
21	NO. 5 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
22	NO. 6 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
23	NO. 7 THROW	14.13	39.23	215.0	CrMo STEEL	780.0	CRANK	1.000
24	NO. 8 THROW	14.13	47.61	160.0	CrMo STEEL	780.0	CRANK	1.000
25	GEAR	0.981	47.15	158.0	CrMo STEEL	780.0	CRANK	1.000
26	DAMPER INNER	2.587	0.701					1.000
27	DAMPER OUTER	10.67						1.000

UNIV. J. : UNIVERSAL JOINT      G. L. C. : GEISLINGER COUPLING      STM. C. : STROMAG COUPLING

NOTE : 1. Above system(for rotor, etc.) is not changed to engine speed.

2. About the asterisk(\*), please be referred to the values that maker announced.



## NATURAL FREQUENCIES BY HOLZER TABULATION (WITHOUT DAMPING)

NODE= 1  
 $\omega$ = 33.4745 rad/s  
 F= 5.3276 Hz  
 = 319.658 min<sup>-1</sup>

MASS NO	RELATIVE AMP	RELATIVE TORQUE
[BRANCH-1]		
1	-2.0823	-0.2567
2	-2.0730	-0.2723
3	-1.6074	-0.3078
4	-1.5950	-0.3104
5	-1.5950	-0.3161
6	-1.5238	-0.3314
7	0.9350	-0.3265
8	0.9426	-0.3249
26	0.9426	
[MAIN]		
10	1.6500	0.0139
11	1.6488	0.0238
12	1.6444	0.0336
13	1.5405	0.0427
14	1.5325	0.0522
15	1.5086	0.1483
16	1.0032	0.1857
17	1.0000	0.2015
18	0.9949	0.2173
19	0.9893	0.2329
20	0.9834	0.2485
21	0.9771	0.2640
22	0.9703	0.2793
23	0.9632	0.2946
24	0.9557	0.3097
25	0.9492	0.3107
26	0.9426	-0.0115
27	0.9590	0.0000

NODE= 2  
 $\omega$ = 73.9257 rad/s  
 F= 11.7656 Hz  
 = 705.938 min<sup>-1</sup>

MASS NO	RELATIVE AMP	RELATIVE TORQUE
[BRANCH-1]		
1	-0.2200	-0.1322
2	-0.2152	-0.1401
3	0.0245	-0.1375
4	0.0300	-0.1372
5	0.0300	-0.1367
6	0.0608	-0.1337
7	1.0528	-0.1063
8	1.0553	-0.0981
26	1.0553	
[MAIN]		
10	-2.5096	-0.1031
11	-2.5007	-0.1762
12	-2.4677	-0.2478
13	-1.7005	-0.2971
14	-1.6449	-0.3467
15	-1.4867	-0.8086
16	0.9890	-0.6290
17	1.0000	-0.5518
18	1.0141	-0.4735
19	1.0261	-0.3943
20	1.0362	-0.3143
21	1.0442	-0.2336
22	1.0502	-0.1525
23	1.0540	-0.0711
24	1.0559	0.0104
25	1.0556	0.0161
26	1.0553	-0.0671
27	1.1510	0.0000

NODE= 3  
 $\omega$ = 143.9728 rad/s  
 F= 22.9140 Hz  
 = 1374.839 min<sup>-1</sup>

MASS NO	RELATIVE AMP	RELATIVE TORQUE
[BRANCH-1]		
1	-0.3168	-0.7225
2	-0.2907	-0.7628
3	1.0141	-0.3485
4	1.0281	-0.3167
5	1.0281	-0.2489
6	1.0842	-0.0470
7	1.4330	0.0943
8	1.4307	0.1367
26	1.4307	
[MAIN]		
10	24.8948	3.8805
11	24.5603	6.6016
12	23.3240	9.1688
13	-5.0623	8.6116
14	-6.6749	7.8492
15	-10.2574	-4.2402
16	0.9373	-3.5946
17	1.0000	-3.3017
18	1.0842	-2.9842
19	1.1602	-2.6443
20	1.2276	-2.2848
21	1.2859	-1.9082
22	1.3345	-1.5173
23	1.3732	-1.1151
24	1.4016	-0.7046
25	1.4164	-0.6758
26	1.4307	-0.4624
27	2.0903	0.0000

NODE= 4  
 $\omega$ = 159.2373 rad/s  
 F= 25.3434 Hz  
 = 1520.604 min<sup>-1</sup>

MASS NO	RELATIVE AMP	RELATIVE TORQUE
[BRANCH-1]		
1	5.3869	15.0274
2	4.8427	15.8493
3	-22.2667	4.7204
4	-22.4565	3.8710
5	-22.4565	2.0602
6	-22.9205	-3.1614
7	0.5322	-3.0972
8	0.6045	-3.0753
26	0.6045	
[MAIN]		
10	0.9616	0.1834
11	0.9458	0.3116
12	0.8875	0.4311
13	-0.4470	0.3709
14	-0.5165	0.2987
15	-0.6528	-0.6425
16	1.0035	0.2031
17	1.0000	0.5614
18	0.9857	0.9145
19	0.9624	1.2593
20	0.9303	1.5926
21	0.8897	1.9114
22	0.8410	2.2127
23	0.7846	2.4938
24	0.7210	2.7521
25	0.6632	2.7686
26	0.6045	-0.2670
27	0.9854	-0.0004

## NATURAL FREQUENCIES BY HOLZER TABULATION (WITHOUT DAMPING)

NODE= 5  
 $\omega = 254.8016$  rad/s  
 $F = 40.5529$  Hz  
 $= 2433.176$  min<sup>-1</sup>

NODE= 6  
 $\omega = 498.9127$  rad/s  
 $F = 79.4044$  Hz  
 $= 4764.265$  min<sup>-1</sup>

MASS NO	RELATIVE AMP	RELATIVE TORQUE
【BRANCH-1】		
1	-0.0009	-0.0067
2	-0.0007	-0.0070
3	0.0112	0.0074
4	0.0109	0.0085
5	0.0109	0.0107
6	0.0085	0.0157
7	-0.1079	-0.0176
8	-0.1075	-0.0276
26	-0.1075	
【MAIN】		
10	0.0560	0.0273
11	0.0536	0.0459
12	0.0450	0.0614
13	-0.1452	0.0114
14	-0.1473	-0.0413
15	-0.1285	-0.5155
16	1.0297	1.7061
17	1.0000	2.6235
18	0.9331	3.4795
19	0.8444	4.2541
20	0.7360	4.9293
21	0.6103	5.4892
22	0.4704	5.9208
23	0.3195	6.2139
24	0.1611	6.3617
25	0.0275	6.3634
26	-0.1075	6.3177
27	-9.1200	0.0000

MASS NO	RELATIVE AMP	RELATIVE TORQUE
【BRANCH-1】		
1	-0.0009	-0.0253
2	0.0000	-0.0253
3	0.0433	0.1872
4	0.0358	0.2004
5	0.0358	0.2288
6	-0.0157	0.1936
7	-1.4517	-1.5259
8	-1.4161	-2.0296
26	-1.4161	
【MAIN】		
10	0.6054	1.1331
11	0.5077	1.8085
12	0.1690	2.0319
13	-6.1218	-6.0594
14	-4.9870	-12.8992
15	0.9003	-0.1567
16	1.1653	9.4823
17	1.0000	12.9995
18	0.6686	15.3512
19	0.2773	16.3266
20	-0.1389	15.8382
21	-0.5426	13.9299
22	-0.8977	10.7726
23	-1.1723	6.6496
24	-1.3418	1.9304
25	-1.3823	1.5929
26	-1.4161	-1.3486
27	0.5078	-0.0001

# GENERATOR ON

2335M-0054 (35/42)

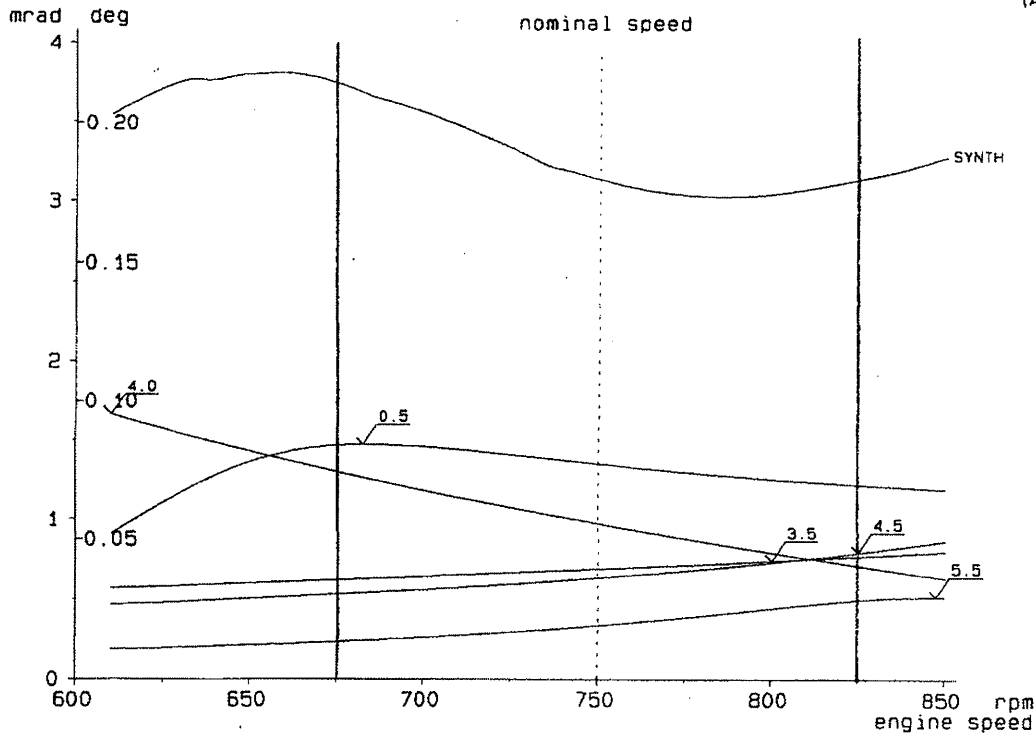
Engine : BL28HX  
Normal firing

Free programmable operating law

CN 0  
29-JAN-88  
V 7.0-01

## VIBRATORY ANGLE AT FREE END

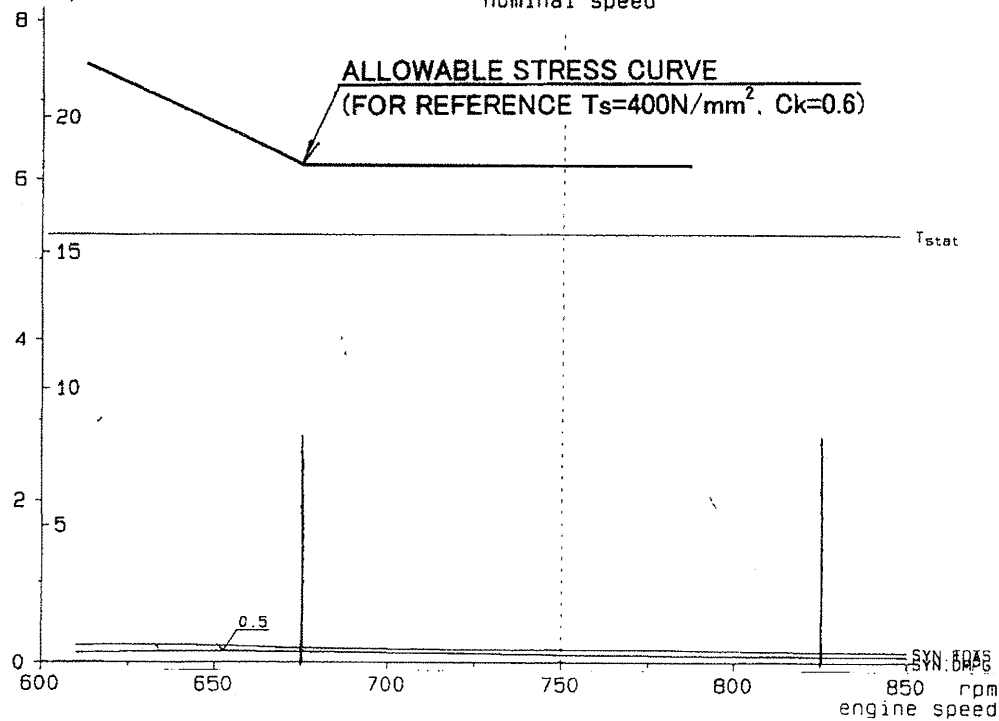
Inertia no.26  
(AMFRE)



## VIBRATORY TORQUE AND STRESS ROTOR SHAFT

Results referred to real speed 1 : 0.4167  $\phi 120$  mm  
kNm N/mm<sup>2</sup> nominal speed

Between no.1 - 2  
(ROTOR)



# GENERATOR ON

2335M-0054 (36/42)

Engine : 8L28HX  
Normal firing

Free programmable operating law

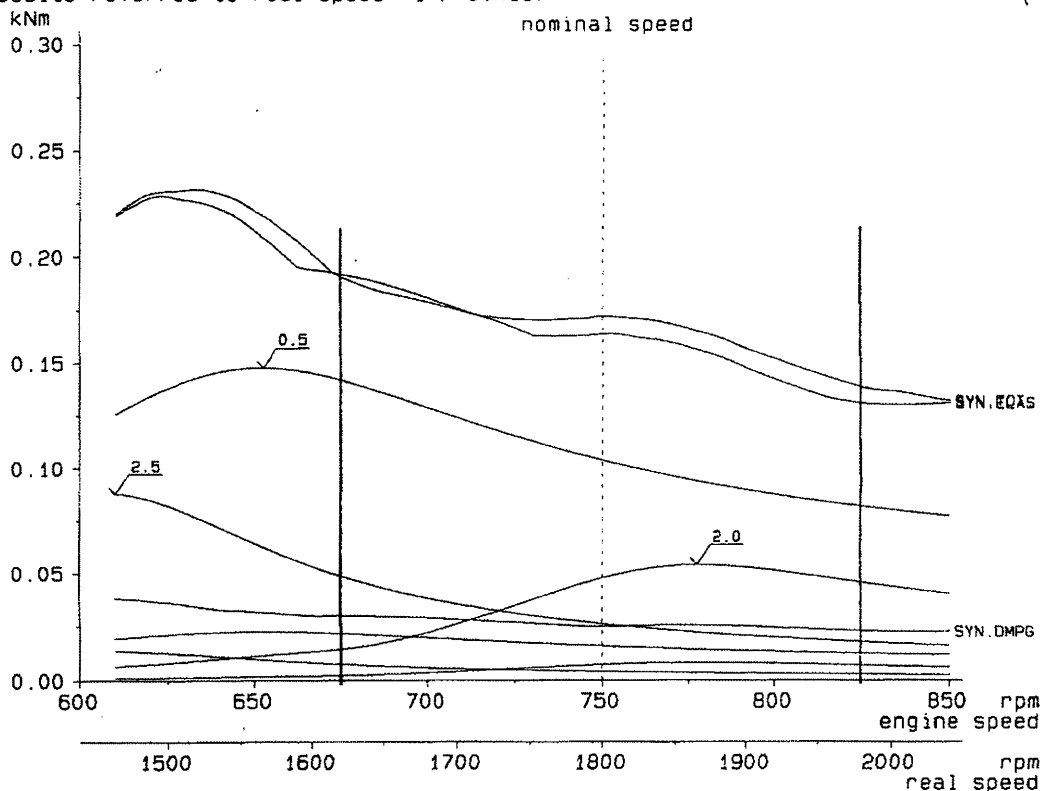
CN 0  
29-JAN-88  
V 7.0-01

## VIBRATORY TORQUE COUPLING PVN54931W

Results referred to real speed 1 : 0.4167

Between no.2 - 3

( )

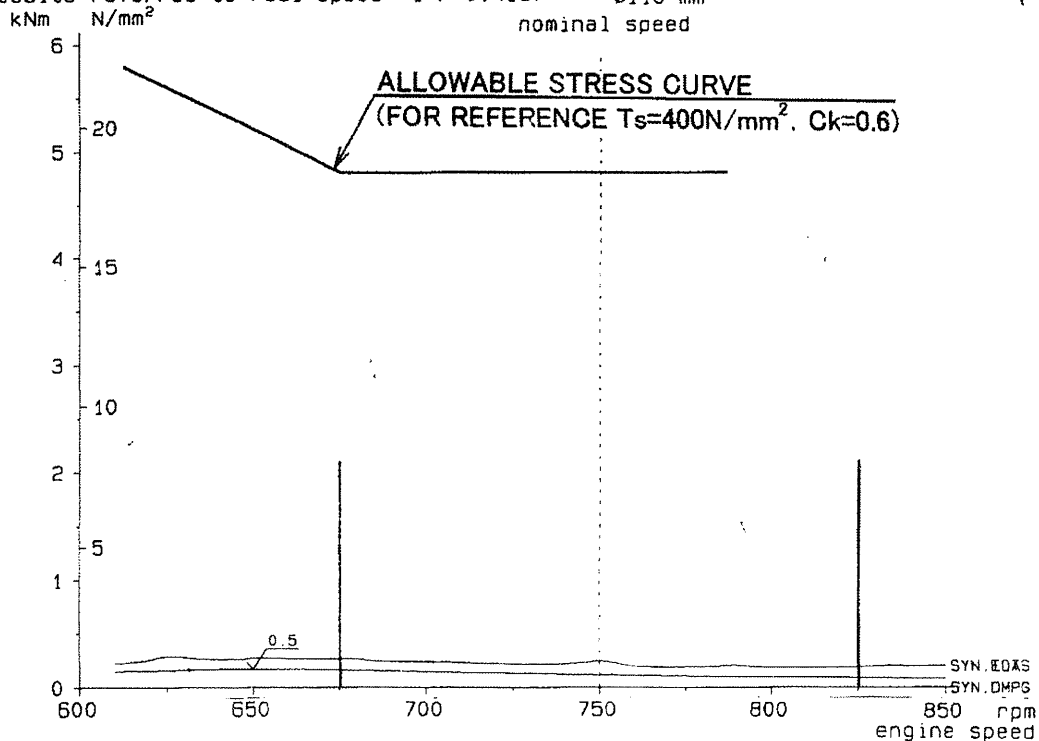


## VIBRATORY TORQUE AND STRESS GEARBOX OUTPUTSHAFT

Results referred to real speed 1 : 0.4167  $\phi 110$  mm

Between no.3 - 4

( )



# GENERATOR ON

2335M-0054 (37/42)

Engine : 8L28HX  
Normal firing

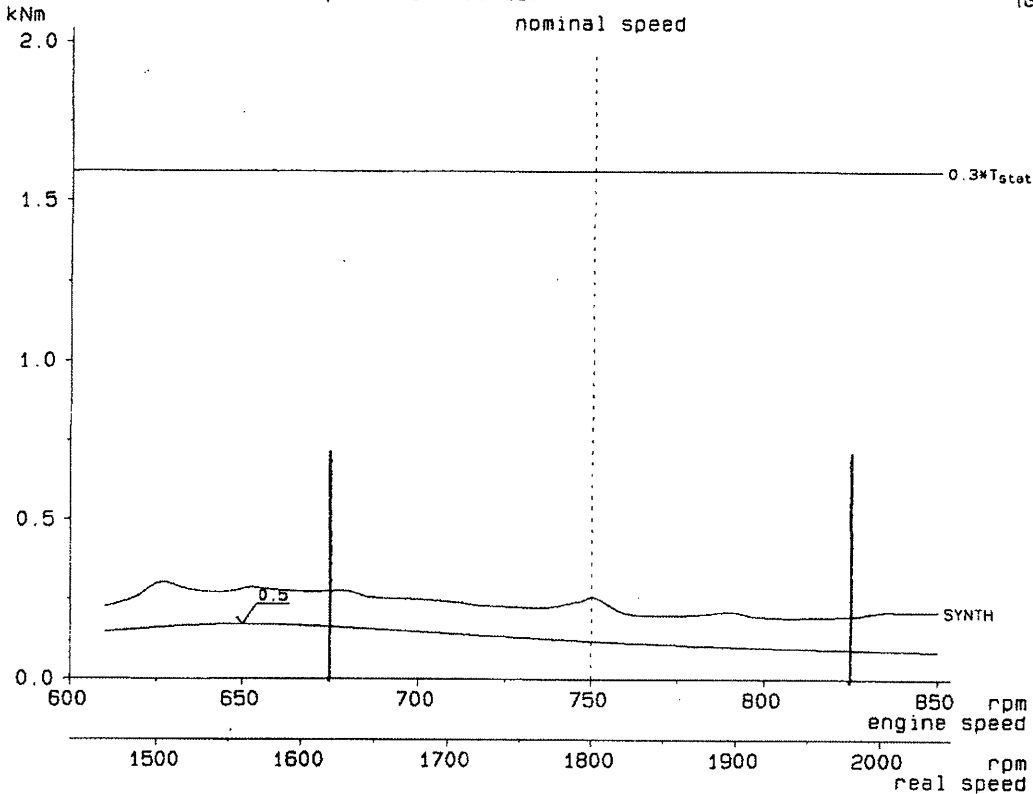
Free programmable operating law

CN 0  
29-JAN-\*\*  
V 7.0-01

## VIBRATORY TORQUE PTOGEAR

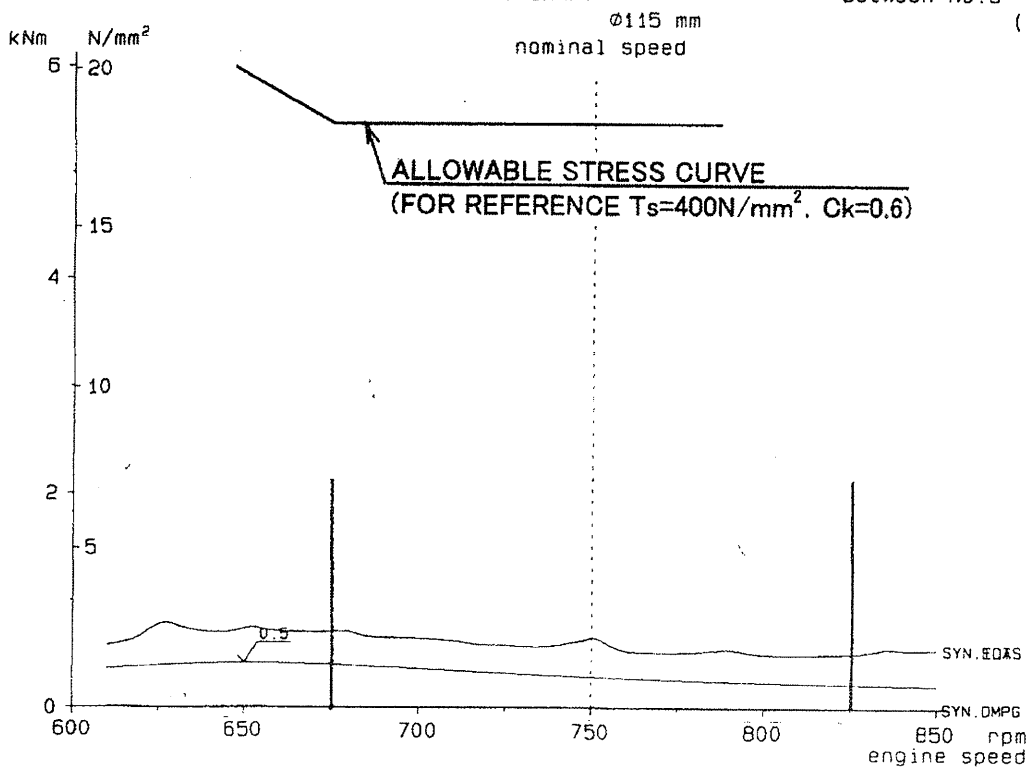
Results referred to real speed 1 : 0.4167

Between no.4 - 5  
(GEAR)



## VIBRATORY TORQUE AND STRESS GEARBOX INPUTSHAFT

Between no.5 - 6  
( )



# GENERATOR ON

2335M-0054 (38/42)

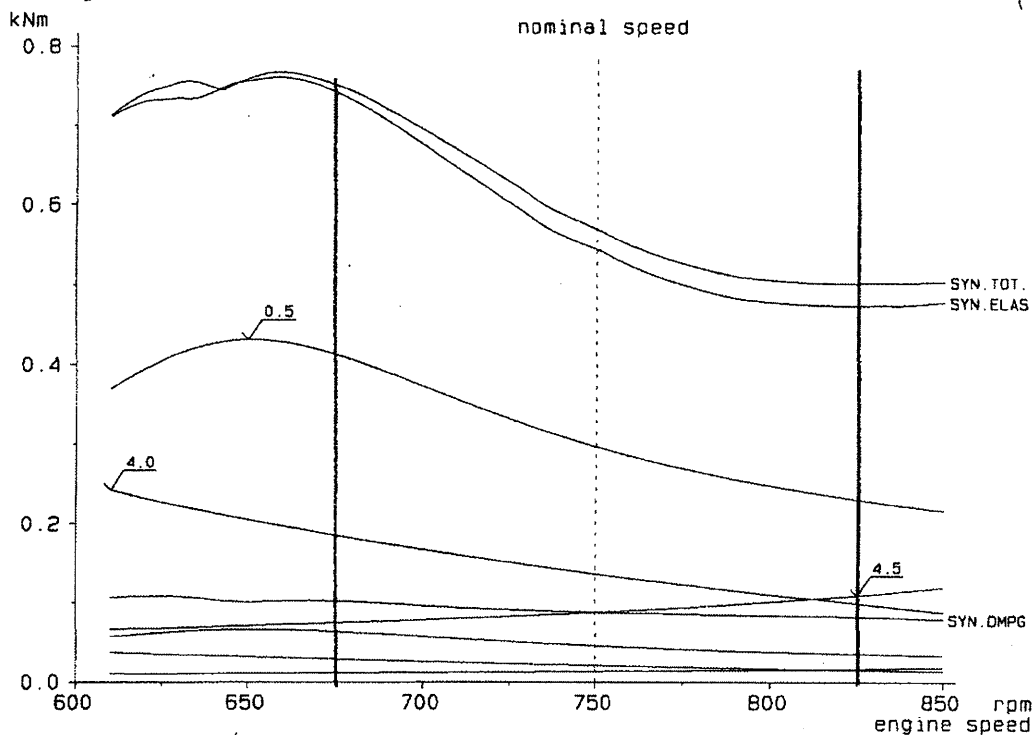
Engine : BL28HX  
Normal firing

Free programmable operating law

CN 0  
29-JAN-\*\*  
V 7.0-01

VIBRATORY TORQUE COUPLING PVN66631W

Between no.6 - 7  
( )

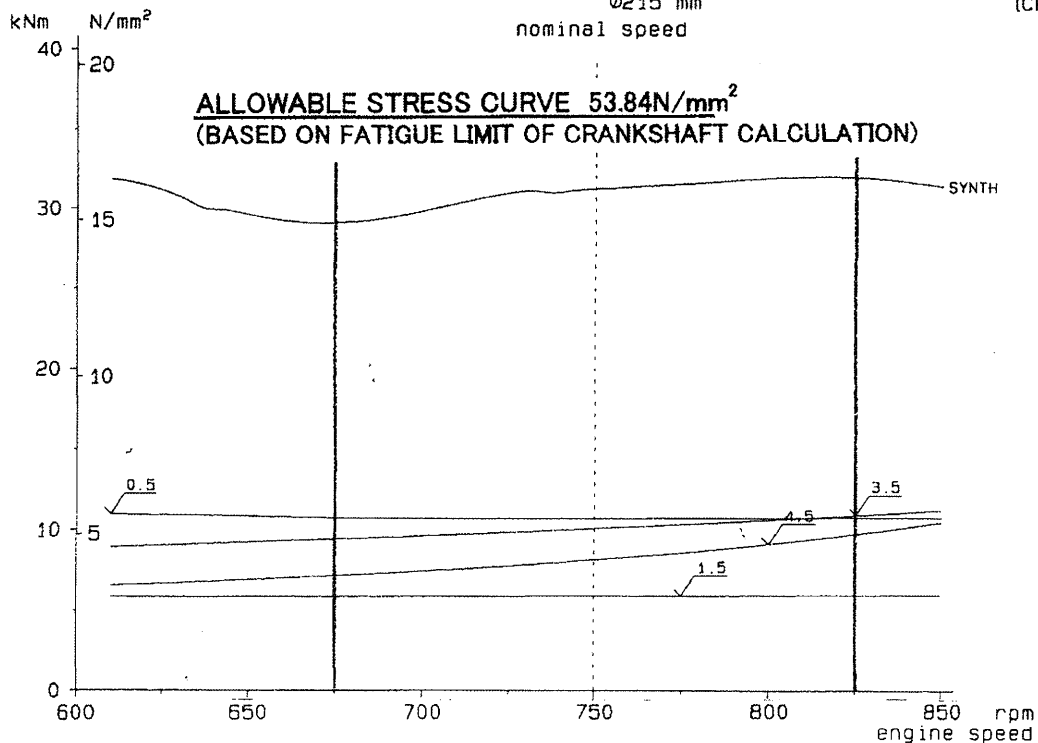


VIBRATORY TORQUE AND STRESS POSITION OF MAXIMUM STRESS

Between no.20 - 21  
(CRANK)

Ø215 mm

nominal speed



# GENERATOR ON

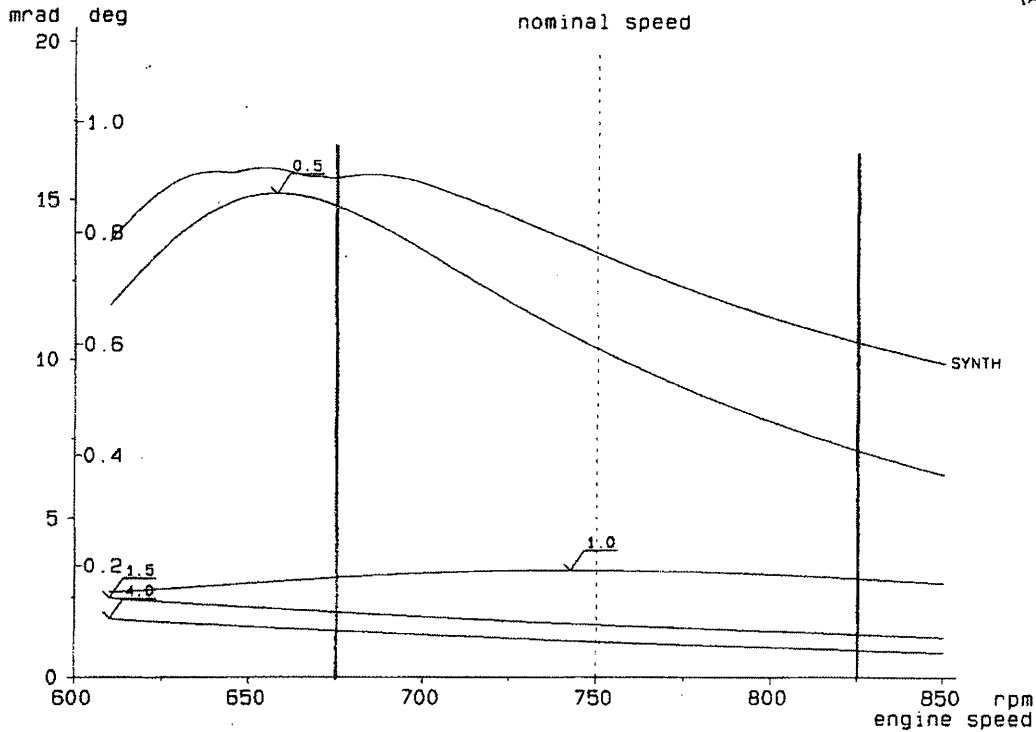
2335M-0054 (39/42)

Engine : 8L28HX Free programmable operating law  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

CN 0  
29-JAN-88  
V 7.0-01

VIBRATORY ANGLE AT FREE END

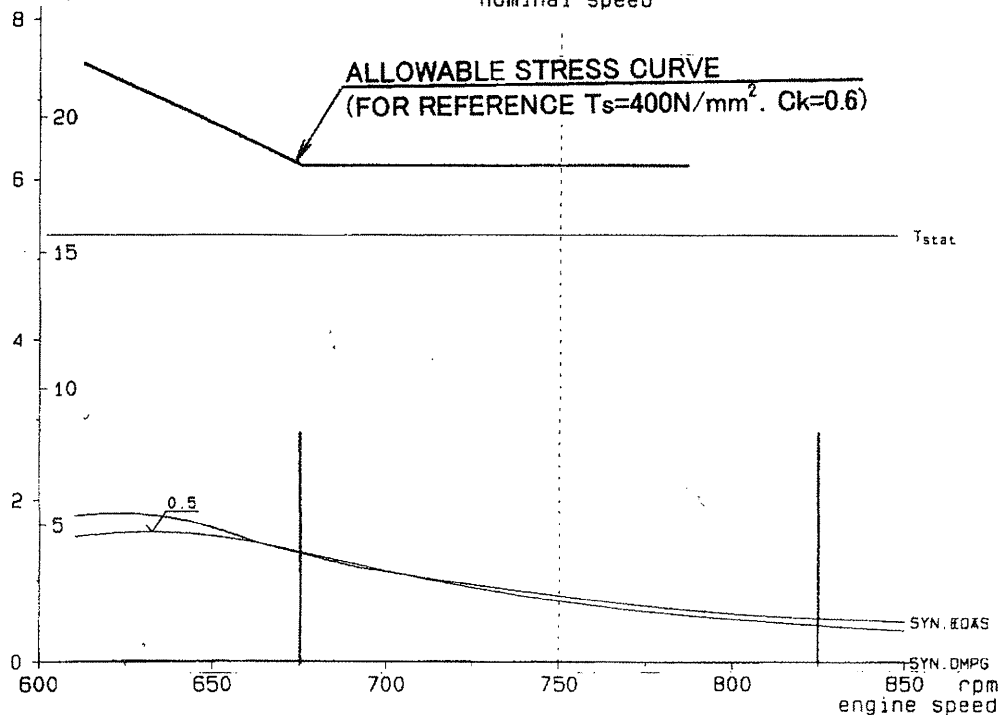
Inertia no.26  
(AMFRE)



## VIBRATORY TORQUE AND STRESS ROTOR SHAFT

Results referred to real speed 1 : 0.4167  $\phi 120$  mm  
nominal speed

Between no.1 - 2  
(ROTOR)



# GENERATOR ON

2335M-0054 (40/42)

Engine : 8L28HX Free programmable operating law  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

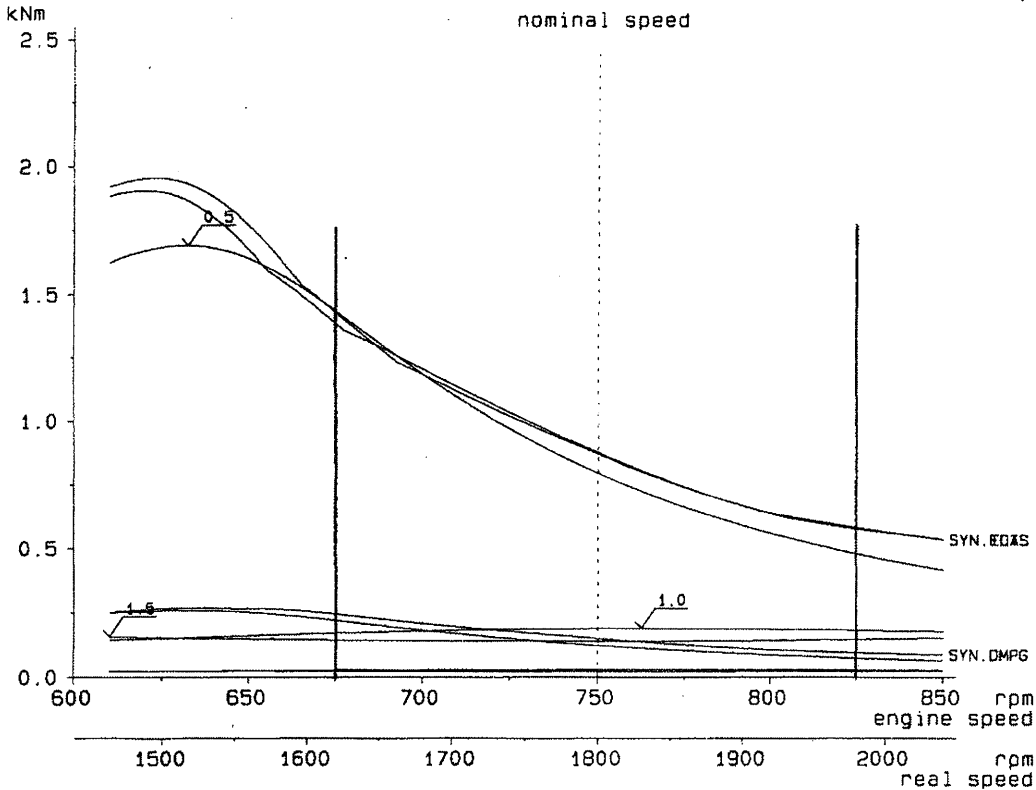
CN 0  
29-JAN-xx  
V 7.0-01

## VIBRATORY TORQUE COUPLING PVN54931W

Results referred to real speed 1 : 0.4167

Between no.2 - 3

( )

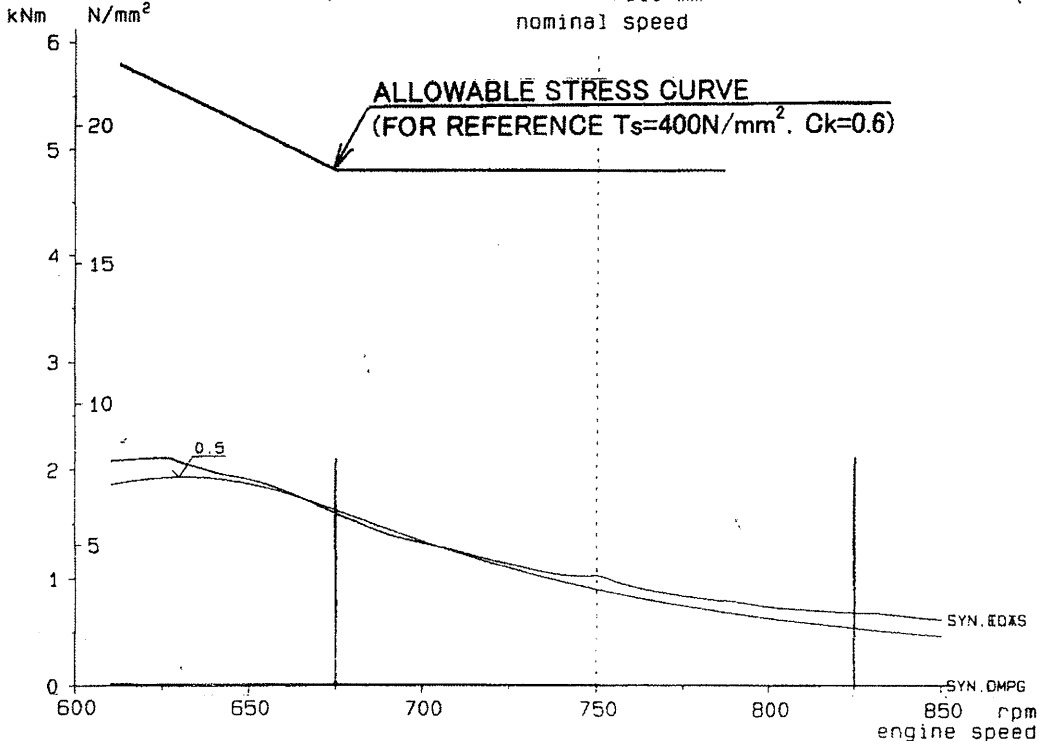


## VIBRATORY TORQUE AND STRESS GEARBOX OUTPUTSHAFT

Results referred to real speed 1 : 0.4167  $\phi 110$  mm

Between no.3 - 4

( )





# GENERATOR ON

2335M-0054 (41/42)

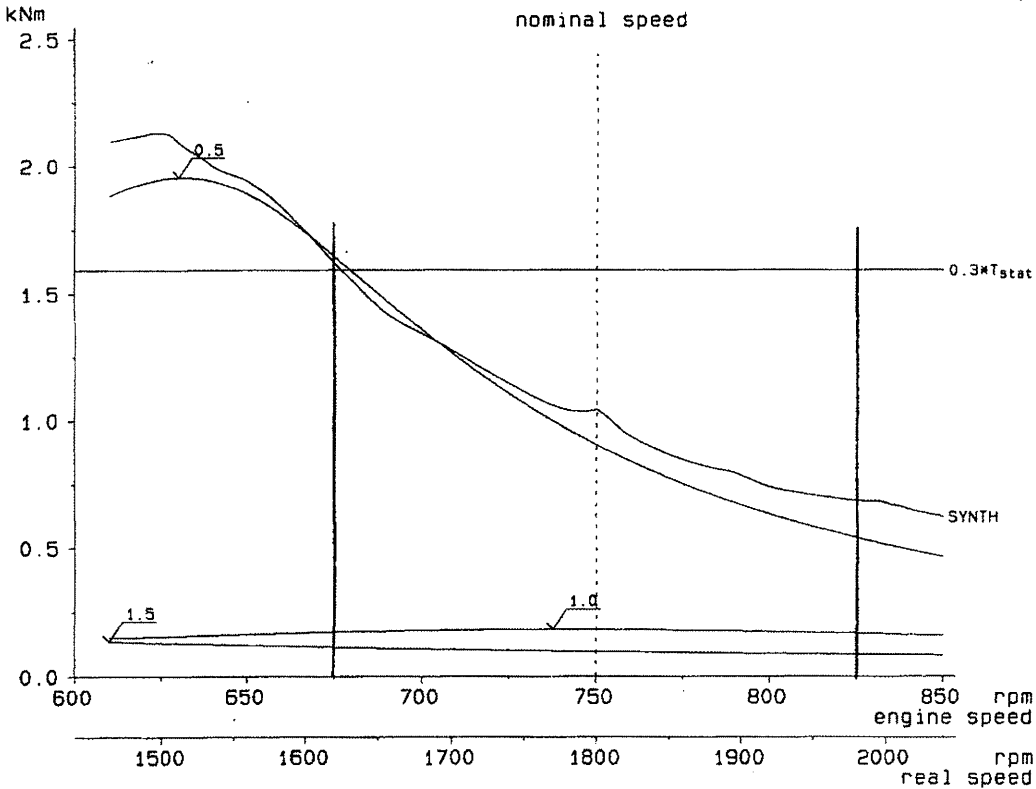
Engine : 8L28HX Free programmable operating law  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

CN 0  
29-JAN-\*\*  
V 7.0-01

## VIBRATORY TORQUE PTOGEAR

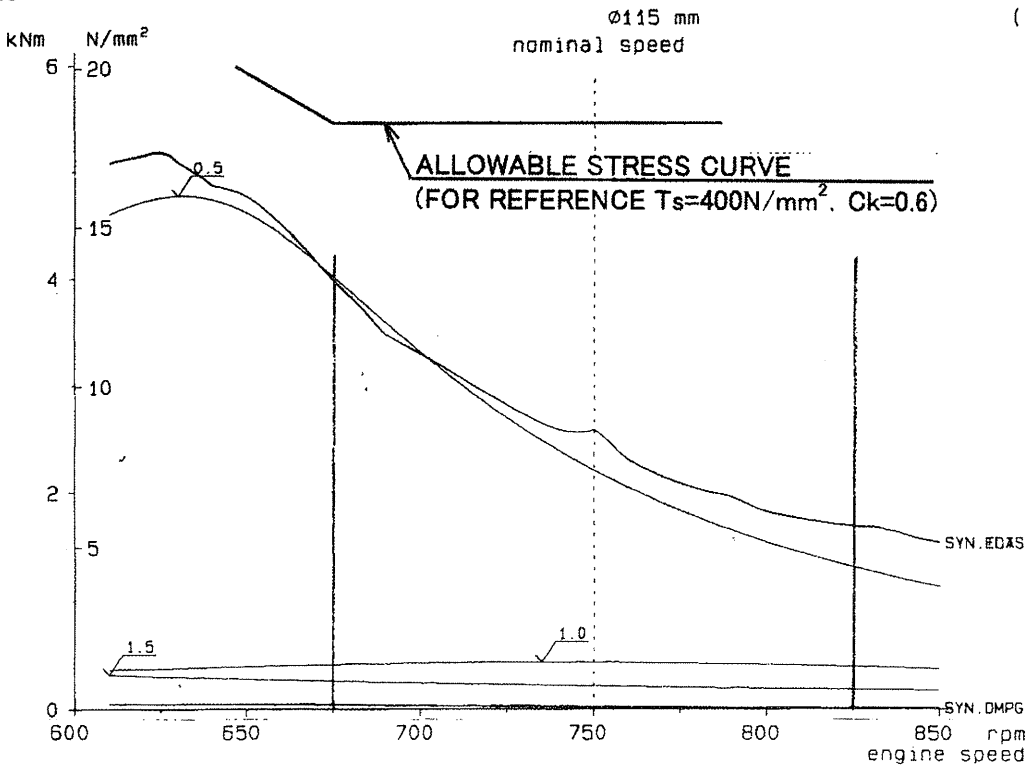
Results referred to real speed 1 : 0.4167

Between no.4 - 5  
(GEAR)



## VIBRATORY TORQUE AND STRESS GEARBOX INPUT SHAFT

Between no.5 - 6  
( )



# GENERATOR ON

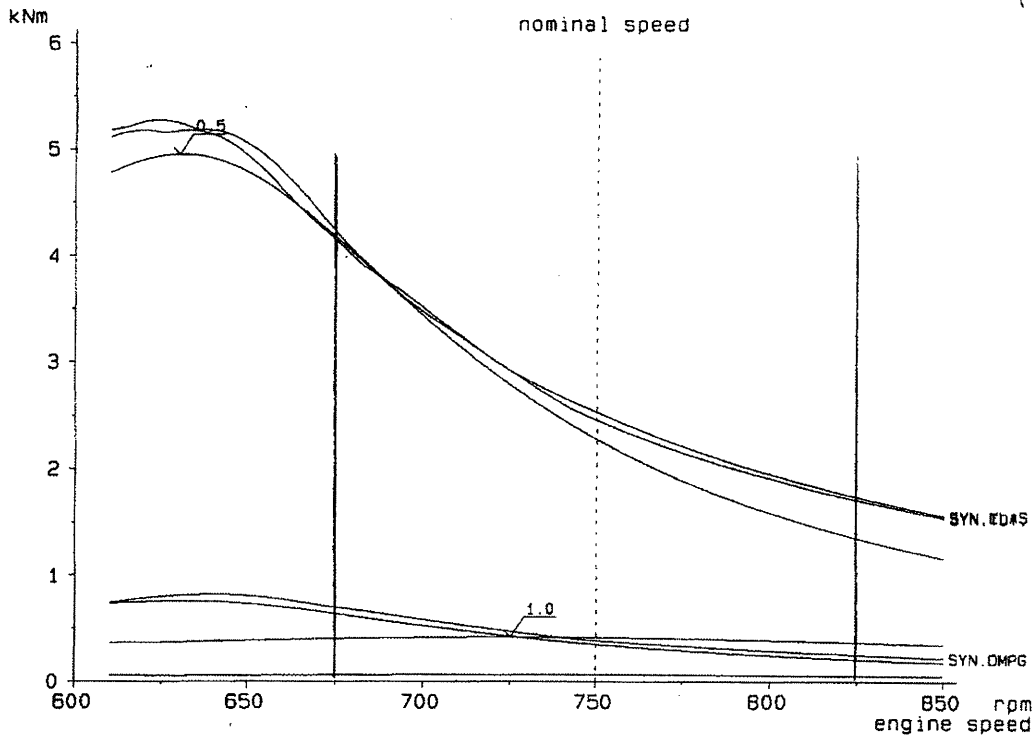
2335M-0054 (42/42)

Engine : BL28HX Free programmable operating law  
Misfiring cyl. 8 according compression  
BMEP of the firing cylinders 14.3 % uprated

CN 0  
29-JAN-\*\*  
V 7.0-01

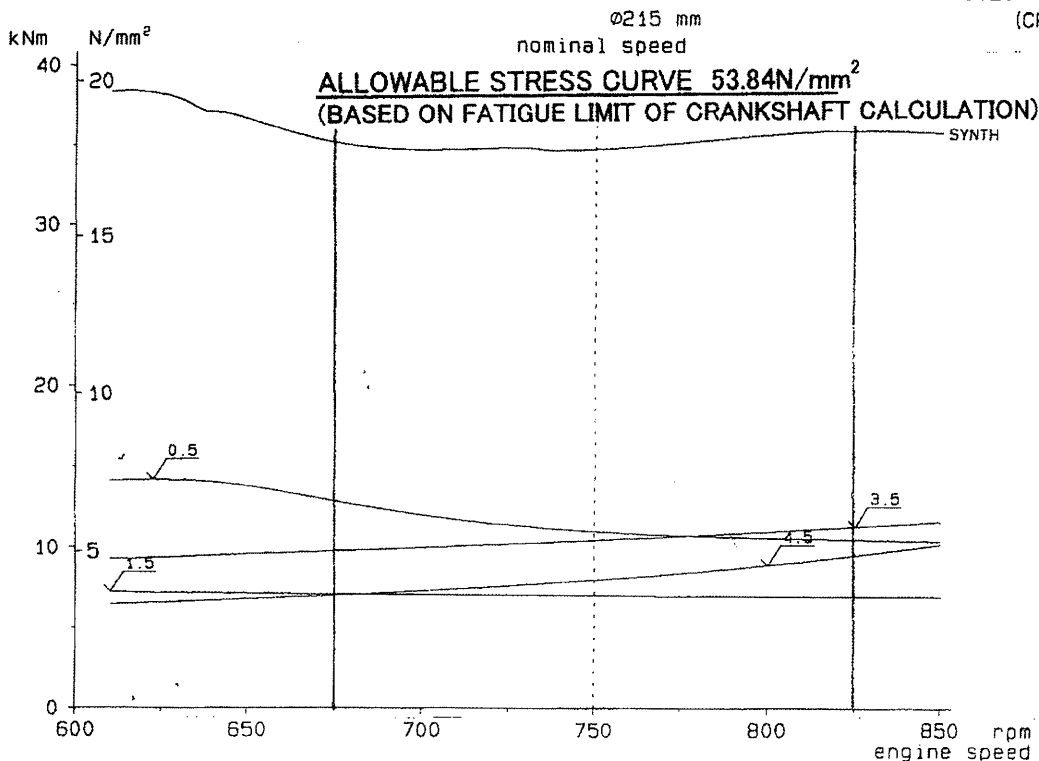
VIBRATORY TORQUE COUPLING PVN66631W

Between no.6 - 7



VIBRATORY TORQUE AND STRESS POSITION OF MAXIMUM STRESS

Between no.20 - 21  
(CRANK)



## CALCULATION RESULT OF TORSIONAL VIBRATION FOR EACH CYLINDER MISFIRE

CUSTOMER	JAYA SHIPBUILDING & ENGINEERING TED LTD.		
SHIPYARD	PT. JAYA ASIATIC SHIPYARD		
ENGINE TYPE	8L28HX	SHIP NO. 888B / 889B	
RATED POWER / SPEED	2206kW/750min-1	JOB NO. K242735/K242737	

## NOTE :

In these sheets, we show the calculation result of torsional vibration in the case of each cylinder misfire.  
The calculation result at the rated speed and the resonance is summarized in the below table.

CYLINDER NO. FOR MISFIRING										Ratio of	Ratio of
#1	#2	#3	#4	#5	#6	#7	#8	#9		Max-Min	Max-#6
< FORWARD >											
At rated speed 750min <sup>-1</sup>											
	Vibratory stress[N/mm <sup>2</sup> ] of crankshaft					Min. dia.[mm]				215	
SYNTH	33.71	31.68	34.84	34.85	35.04	34.93	32.13	34.78		10.6%	0.7%
No.10	Vibratory stress[N/mm <sup>2</sup> ] of propeller shaft					260					
0.5 order	4.04	4.26	4.09	4.1	4.4	4.4	4.23	4.42			
1.0 order	1.75	1.71	1.81	1.74	1.76	1.86	1.79	1.86			
1.5 order	0.78	0.71	0.44	0.6	0.77	0.88	0.64	0.51			
3.0 order	0.27	0.2	0.37	0.39	0.44	0.54	0.48	0.64			
SYNTH	5.72	5.89	5.86	5.65	6.15	6.02	5.86	6.17		9.2%	0.0%
No.11	Vibratory torque[Nm] of lower bevel gearing										
0.5 order	15030	15840	15220	15270	16360	16380	15750	16470			
1.0 order	6450	6312	6689	6431	6492	6871	6613	6878			
1.5 order	2840	2594	1605	2194	2813	3213	2325	1865			
3.0 order	896	670	1198	1277	1450	1773	1592	2099			
SYNTH	20730	21190	21260	20310	22240	21730	21300	22330		9.9%	0.0%
No.15	Vibratory torque[Nm] of upper bevel gearing										
0.5 order	4979	5245	5042	5058	5420	5426	5217	5455			
1.0 order	2069	2025	2146	2063	2083	2204	2122	2206			
1.5 order	857	783	484	662	849	970	702	563			
3.0 order	177	132	236	252	286	350	314	414			
SYNTH	6594	6678	6791	6422	7076	6952	6870	7100		10.6%	0.0%
No.17	Vibratory stress[N/mm <sup>2</sup> ] of input shaft of clutch					140					
0.5 order	10.69	11.26	10.83	10.86	11.64	11.65	11.2	11.72			
1.0 order	4.28	4.19	4.44	4.27	4.31	4.56	4.39	4.57			
1.5 order	1.65	1.5	0.93	1.27	1.63	1.86	1.35	1.08			
2.0 order	0.22	0.25	0.24	0.26	0.28	0.29	0.32	0.33			
SYNTH	13.83	14.21	14.37	13.87	14.92	14.93	14.65	14.98		8.3%	0.0%
No.22	Vibratory torque[Nm] of elastic coupling (Geislinger)										
0.5 order	5661	5963	5732	5750	6162	6169	5932	6202			
1.0 order	983	962	1019	980	989	1047	1008	1048			
1.5 order	2217	2025	1253	1712	2195	2508	1815	1456			
4.0 order	1773	1748	1726	1707	1691	1679	1671	1667			
SYNTH	10430	10390	9950	10400	11100	11470	10330	10290		15.3%	11.5%

## ADDITIONAL NOTE :

1. The calculation result of "FORWARD AND GENERATOR ON" is entirely same as "FORWARD".
2. The engine rated power of "GENERATOR ON" is smaller than "FORWARD", and the maximum value of torsional vibration becomes smaller. So we omit the calculation result of "GENERATOR ON".

## CONCLUSION

From these calculation result, we get to know the some tendencies;

1. The difference between maximum torsional vibration at the rated speed and minimum one is 10.6% at the crankshaft, and is 15.3% except the crankshaft.
  2. The maximum value is different by each cylinder misfire.
  3. The difference between the value by #8 cylinder misfire and the maximum value is under 12%.
  4. The barred range by torsional vibration does not change at any one cylinder misfire.
- Therefore we think that torsional vibration calculation at cylinder misfire is enough with the evaluation of the calculation result in the case of #8 cylinder misfire.

CLASS No.	2 3 6 5 M
SUB No.	1 0 0 2 0 (1/6)

MODEL	ZP-41CP	DRAWING No.	

№ 102

## CALCULATION SHEETS OF PROPELLER

2206kW × 750 / 242 min<sup>-1</sup>


MARK	REVISION	APPD.	DRW.	DATE
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**Marine Engineering Group  
Engineering & Technology Center  
NIIGATA POWER SYSTEMS CO., LTD.**

APPROVED	<i>S. Kobayashi</i>
PASSED	<i>S. Kobayashi</i>
CHECKED	Y.Oshio
DRAWN	Y.Oshio
DATE	10th, Mar, 2008

## 1. HULL

SHIP OWNER :

KIND OF SHIP :

SHIPYARD :

HULL NO. :

DIMENSION :

## 2. ENGINE

MAKER :

MODEL :

BHP & RPM : 2206 kW (3000ps) × /242 min<sup>-1</sup> (2 SETS)

## 3. DESIGNING CONDITION

1) EHP :

2) PROPELLER DIAMETER : 2700 mm × 4 BLADE CPP (2 SETS)

3) KIND OF PROPELLER : SKEWED KAPLAN

4) SHAFT IMMERSION : 2.7 m

## 4. SYMBOLS

K<sub>q</sub> : TORQUE CONSTANT =  $(75 \cdot \text{BHP} \cdot \eta_t \cdot \eta_r) / (2\pi \cdot \rho \cdot n^3 \cdot D^5)$ J : ADVANCE COEFFICIENT =  $\{Vs \cdot (1-W) \cdot 0.5144\} / (n \cdot D)$  $\eta_o$  : OPEN PROP. EFFICIENCY =  $(J \cdot K_t) / (2\pi \cdot K_q)$ T : THRUST IN Kg =  $\rho \cdot n^2 \cdot D^4 \cdot K_t$ 

W : WAKE FACTOR

t : THRUST DEDUCTION COEFFICIENT

 $\eta_t$  : TRANSMISSION EFFICIENCY $\eta_r$  : RELATIVE ROTATIVE EFFICIENCY = 1.0

5. CALCULATION OF EXPANDED AREA RATIO (E.A.R.)  
 FULL LOAD CONDITION AT 100% M.C.O.

$$\begin{aligned}
 \text{EAR} &= \frac{245 \times \text{DHP} \times 60}{N \times D^3 \times (P_o - e - 0.8 \times R \times r)} \\
 &= \frac{245 \times 3000 \times 0.93 \times 60}{242 \times 2.7^3 \times (12867 - 1107)} \\
 &= 0.732
 \end{aligned}$$

WHERE  $P_o - e = 10340 + (1025 \times 2.7) - 240 = 12867$   
 $0.8 \times R \times r = 0.8 \times 1.35 \times 1025 = 1107$

---

ADOPTED E.A.R. = 0.75

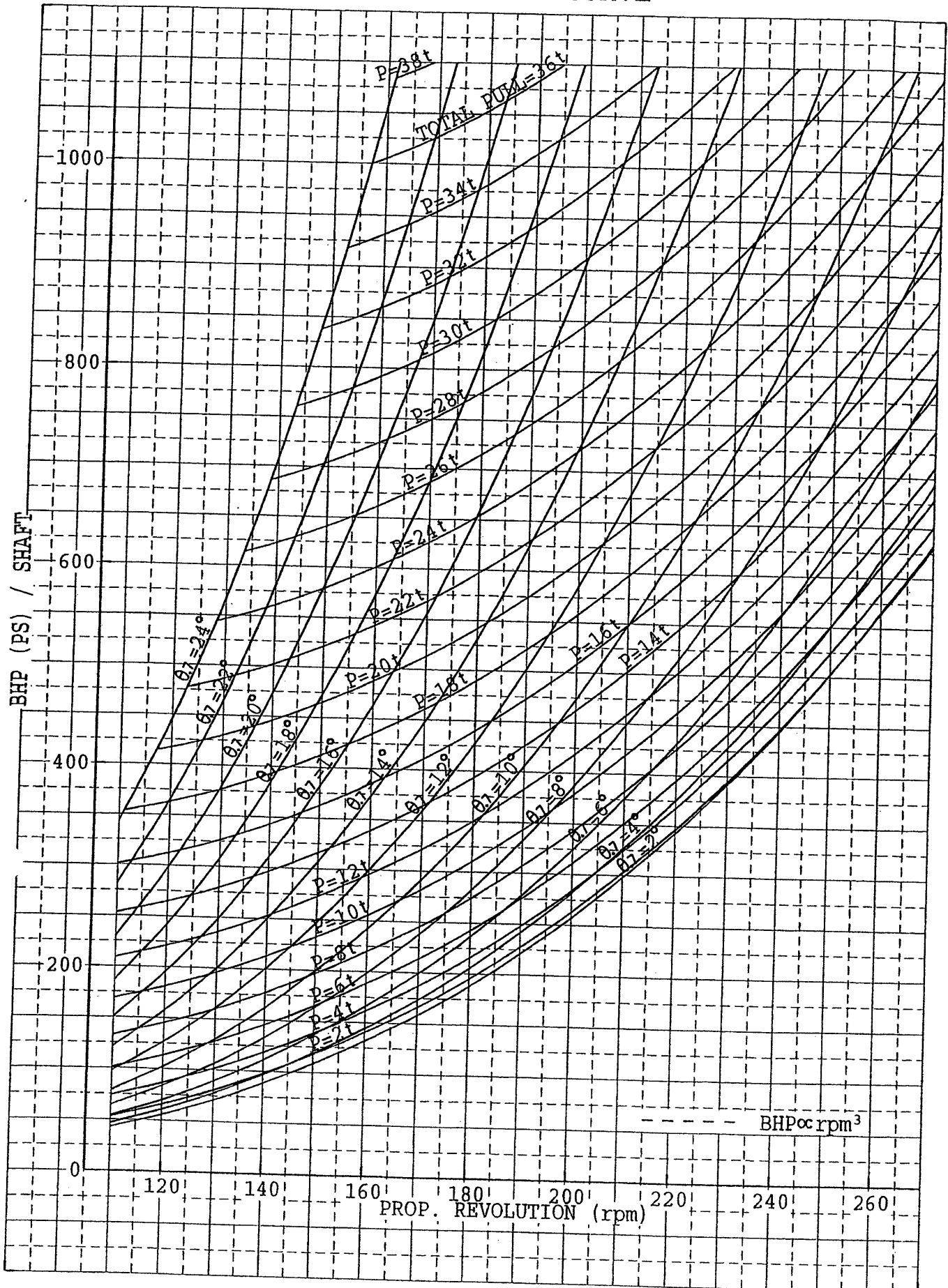
## 6. CALCULATION OF BOLLARD PULL

ENG. LOAD	100%
BHP (PS)	3000
N (min <sup>-1</sup> )	242
Vs (kt)	0
P/D	0.8883
$\theta.7$	22.00°
J	0
T (kg)	38756
PULL (kg) = $T(1-t) = 38756 \times 0.95 = 36818$	
2 x PULL (ton)	73.6

## 7. PROPOSED PROPELLER DIMENSION

DIAMETER	D	= 2700 mm
PITCH PLANNED	P	= 2160 mm
PITCH RATIO	P/D	= 0.8
EXPANDED AREA RATIO	E.A.R.	= 0.75
NUMBER OF BLADES	Z	= 4
MATERIAL	: Ni-Al BRONZE (ABS TYPE 4)	
DIRECTION OF ROTATION	= INWARD	

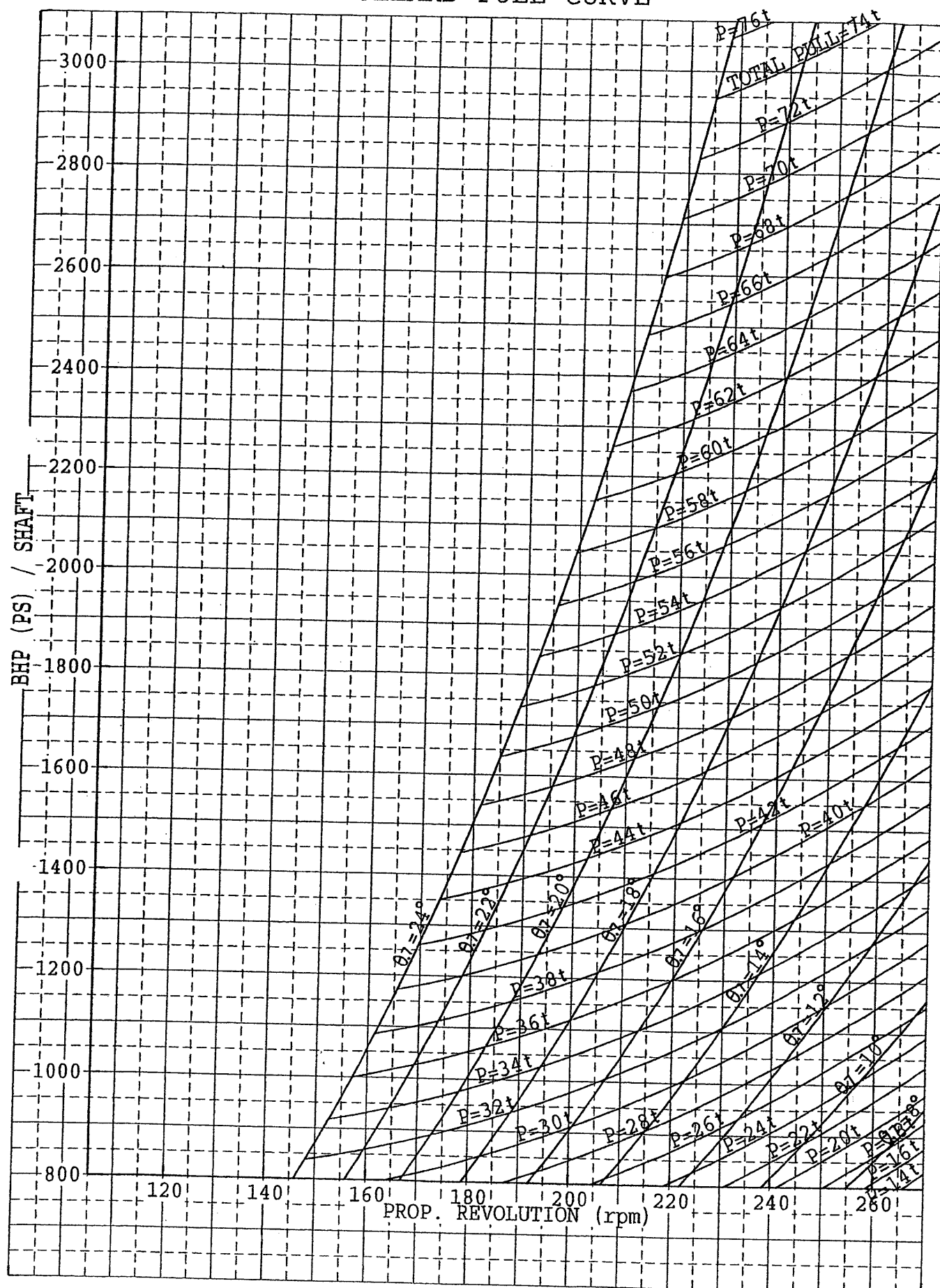
## BOLLARD PULL CURVE





2365M-10020 6/6.5

## BOLLARD PULL CURVE

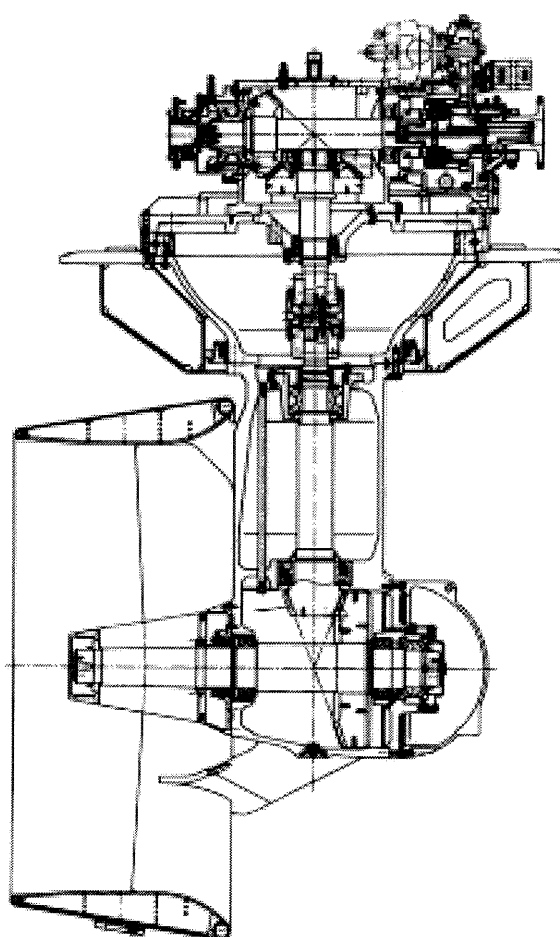


№ 105

**NIIGATA**

NO.20540-00766A

# **INSTALLATION MANUAL FOR NIIGATA Z-PELLER**



Niigata Power Systems Co.,Ltd.

ENGINEERING & TECHNOLOGY CENTER

**INTRODUCTION**

The under-mentioned process should be strictly observed in installing the Z-peller because the Z-peller installation is different from it of the conventional propulsion system in that universal joints are used while no stern tube is utilized for instance.

It should be further noted that the Z-peller main body, intermediate shaft, rubber coupling and main engine respectively should be arranged in proper order and position.

Therefore, each name plate should be carefully checked in order to arrange the parts and units of the starboard system on the starboard side and those of the port system on the port side.

The Z-peller equipment is to be installed in the following order.

1. Z-peller unit
2. Universal joint
3. Intermediate shaft (including the bearing)
4. Geislinger coupling
5. Main engine

来歴	ZP-41CP,GEWES4156-95,BE72/15/140U-9,φ 140 用,軸受注油
A	UJ 取付け表記変更、軸受芯だし削除、GLC 芯だし削除。

## CONTENTS

### SECTION 1. FLOW-CHART OF INSTALLATION AND ALIGNMENT

- (1) Before launching
- (2) After launching

### SECTION 2. PREPARATION WORKS BEFORE MOUNTING Z-PELLER

- (1) Gas free
- (2) Painting for side of mounting base
- (3) Supplied Z-peller
- (4) Preparation of tools to install ZP
- (6) Pressure test of CPP line of lower unit before installation

### SECTION 3. INSTALLATION OF Z-PELLER

- (1) Preparation before installation of Z-Peller
- (2) Positioning of Z-peller
- (3) Disassemble Upper unit
- (4) Preparation to install Lower unit and feedback-chain to Middle unit
- (5) Preparation to install Lower unit
- (6) CPP air test
- (7) Assemble of upper unit
- (8) Loading of lubricating oil
- (9) Pressure test for oil-tight inspection
- (10) Deflation of propeller cylinder
- (11) Preparations for propeller cap

SECTION 4. TENTATIVE INSTALLATION

- (1) Universal joint
- (2) Intermediate shaft
- (3) Intermediate shaft bearing  
**(Part of CENTERING is SEPARATE VOLUME)**
- (4) Main Engine

SECTION 5. ALIGNMENT OF EACH EQUIPMENT

- (1) Universal joint
- (2) Measuring method of tilting angle
- (3) Intermediate shaft
- (4) Geislinger coupling  
**(Part of CENTERING is SEPARATE VOLUME)**
- (5) Chock liner
- (6) Reaming
- (7) Foundation bolt
- (8) Final checking

APPENDIX

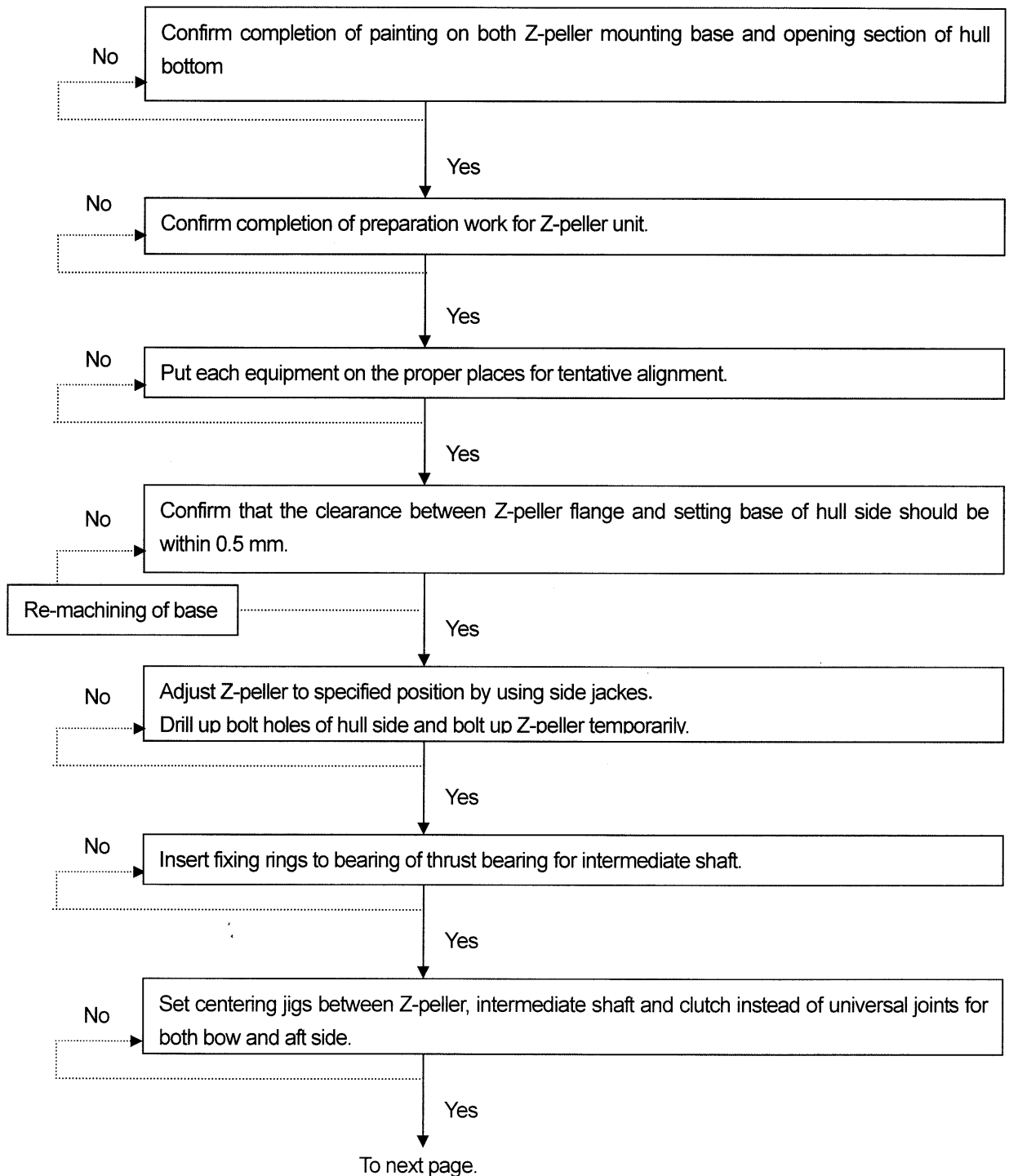
TIGHTENING TORUQUE LIST  
RECORD TABLE

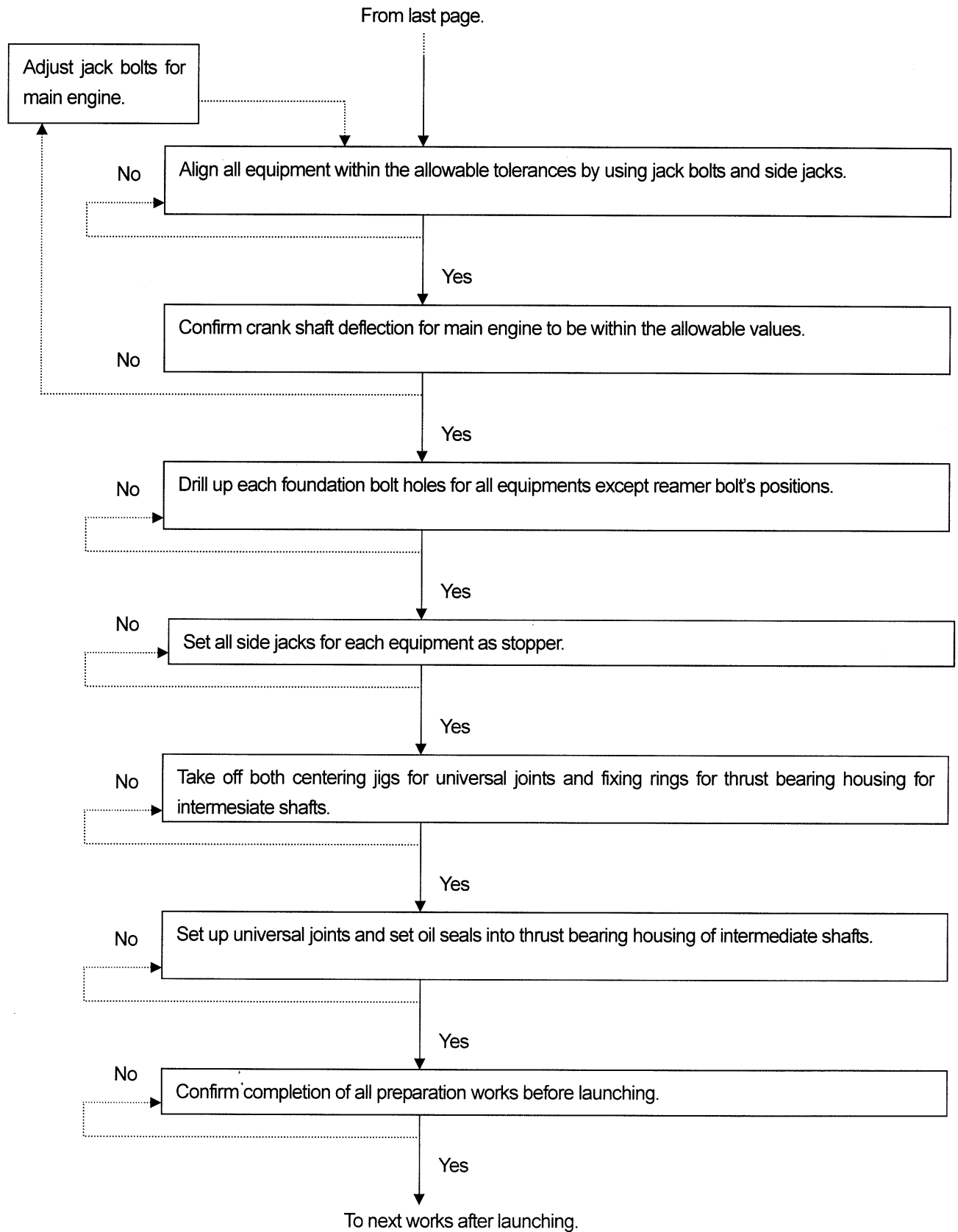
# SECTION 1. FLOW-CHART OF INSTALLATION AND ALIGNMENT

The following flow-chart is used for reference only.

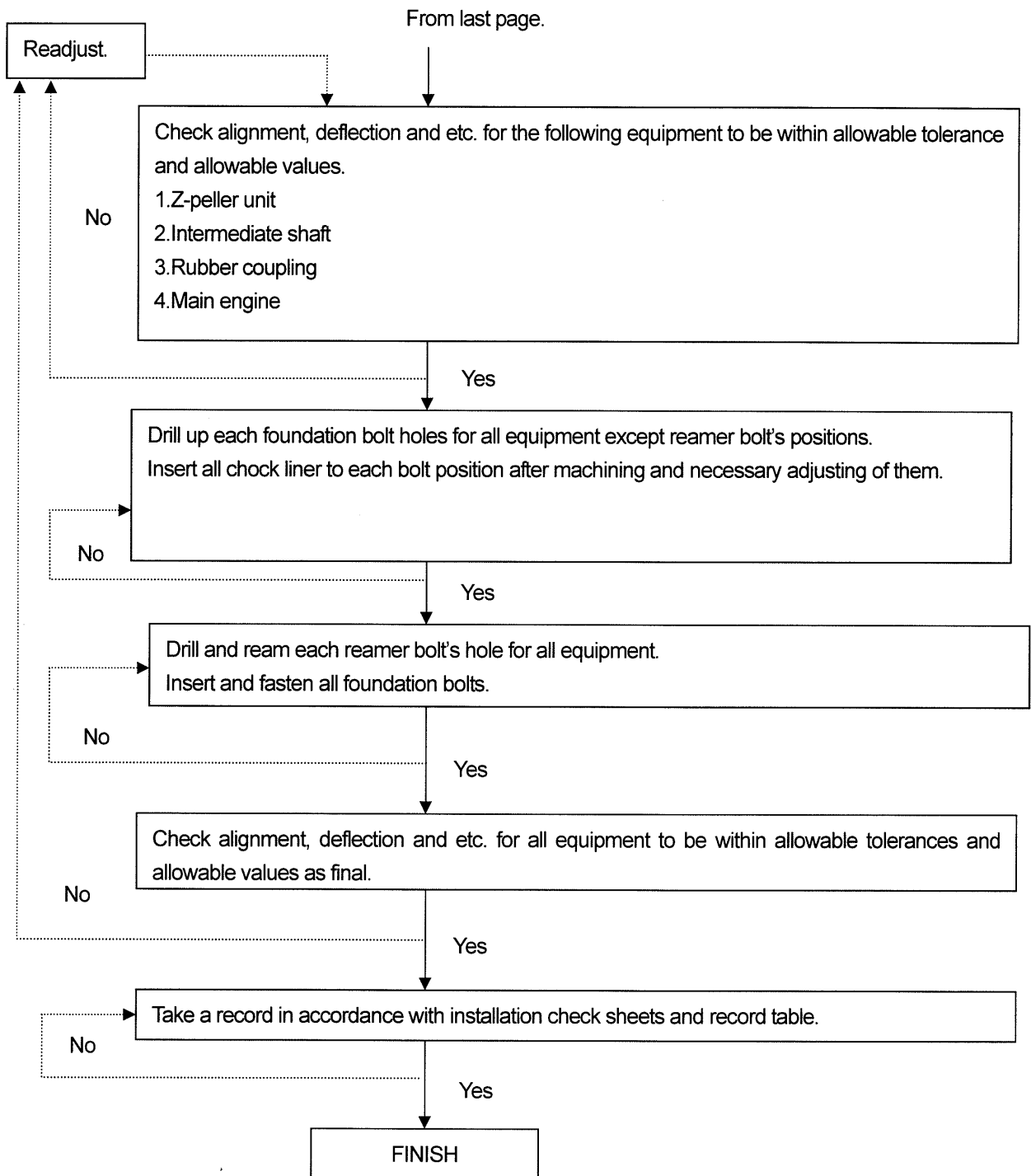
The installation and alignment of Z-peller equipment shall be carried out in accordance with Shipyard's practice and standard.

(1) Before launching





(2) After launching





## SECTION 2. PREPARATION WORKS BEFORE MOUNTING Z-PELLER

Z-peller unit should be mounted on board prior to launching in principle.

And also, the following preparation works shall be carried out before mounting Z-peller.

### (1) Gas free

Z-peller unit has been filled with inert gas prior to delivery from manufacturer in order to prevent the inside of until from the corrosion. Further all openings on unit have been completely sealed by flange plates. (Refer to Fig. 2-1)

Therefore, these flange plates are to be removed and the cocks on pipes are to be opened in order to free the inert gas.

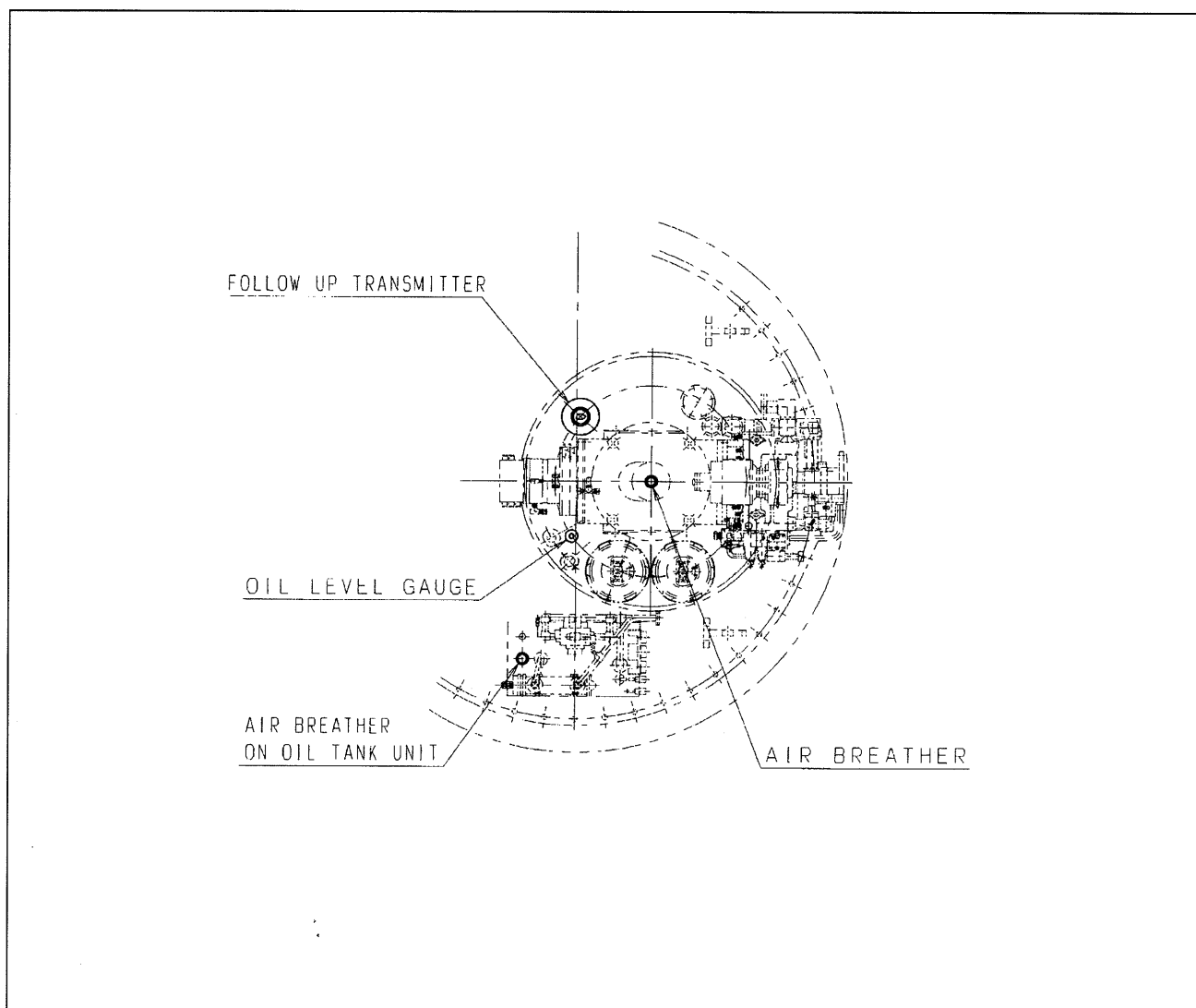


Fig. 2-1

Note : The gas free should be carried out just before loading of lubricating oil

(2) Painting for side of mounting base (Refer to Fig.2-2)

The anti-fouling painting for side section of mounting base, where is enclosed with hull bottom structure shall be carried out before mounting on board of Z-peller.

Also, the anti-corrosive and anti-fouling paintings for opening section of hull bottom shall be carried out before mounting on board of Z-peller.

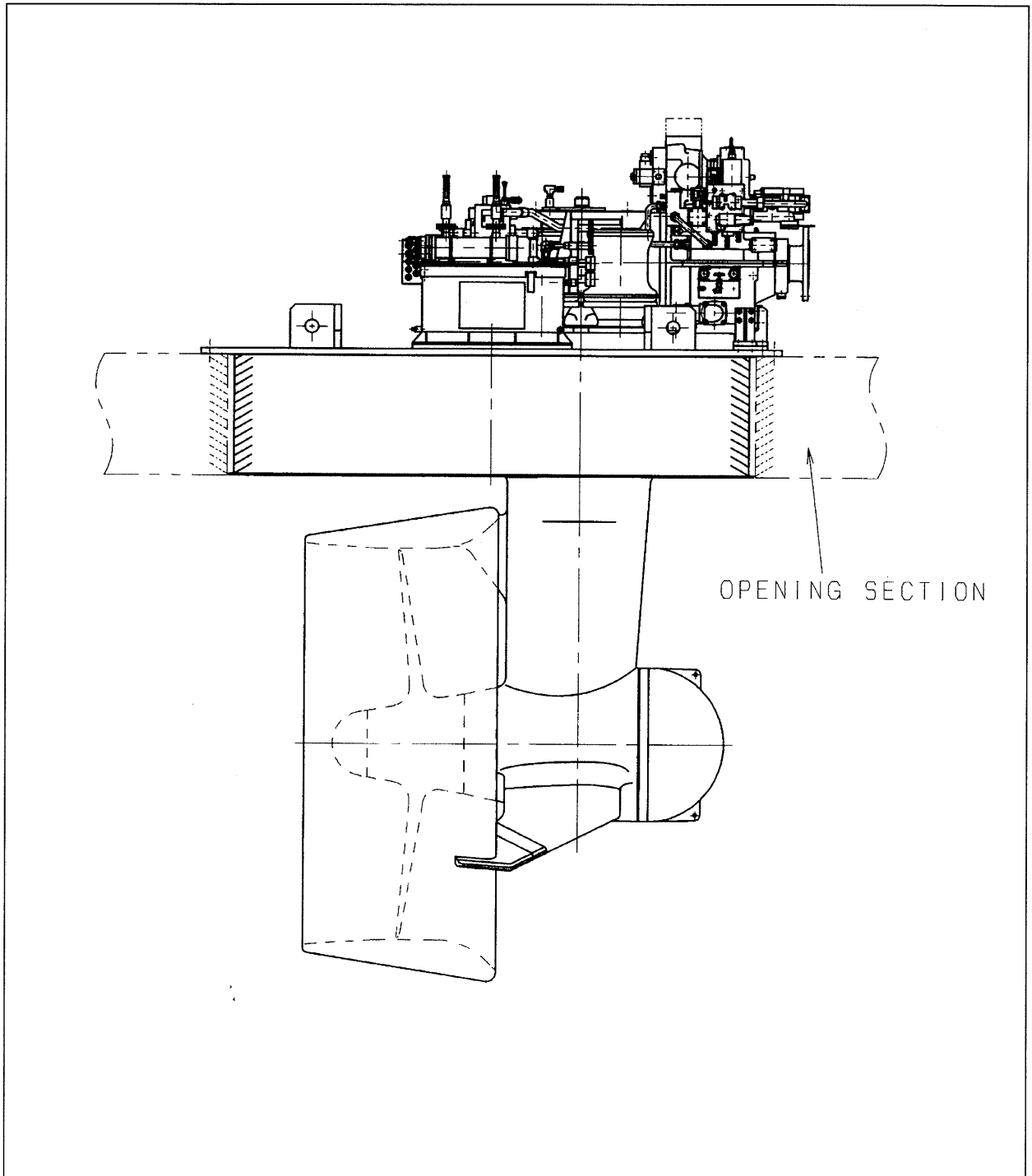
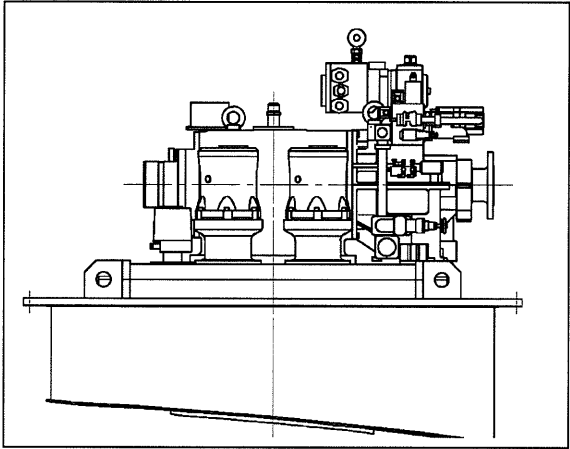
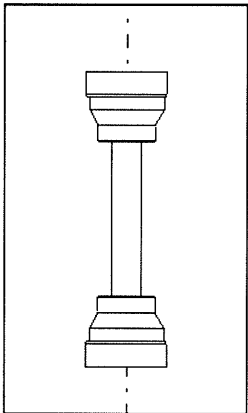


Fig.2-2

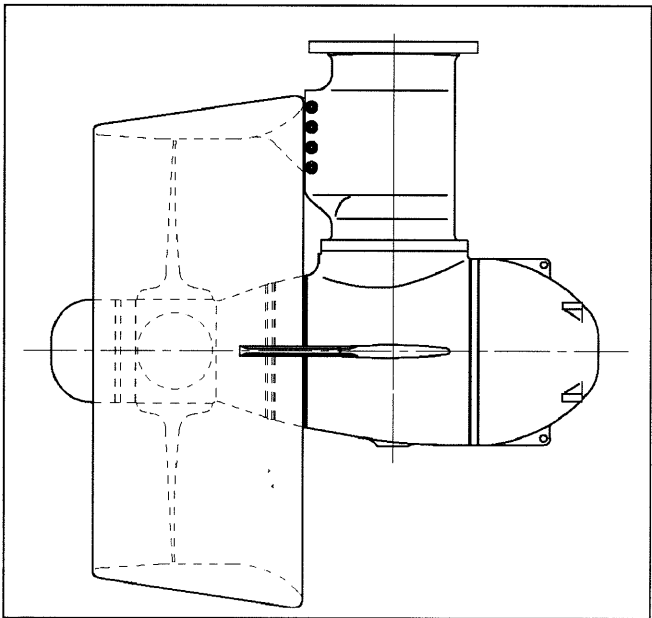
(3) Supplied Z-peller



Upper unit with piping and middle



Vertical shaft with the sleeve of gear couplings



Lower unit

Fig.2-3 Supplied main unit

#### (4) Preparation of tools to install ZP

Please prepare the following tools before disassemble.

- Special tool box for ZP
- Wire and chain for lifting.
- Chain block (10ton / two(2) pieces, 1.5ton / three(3) pieces)
- Eye plate ( ten(10) pieces made of mild steel plate for welding, refer to Fig.2-4-1)
- Guide bolt (two(2) pieces made of steel bar ( Fig.2-4-2, supplied in ZP tool box)
- Long stud bolt : Thread is M42×4.5, Length is 600mm
- Stand for support lower unit. (Fig.2-4-3)
- Air connector set for pressure test. (Fig.2-4-4)

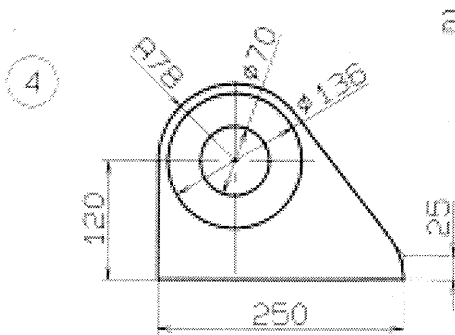
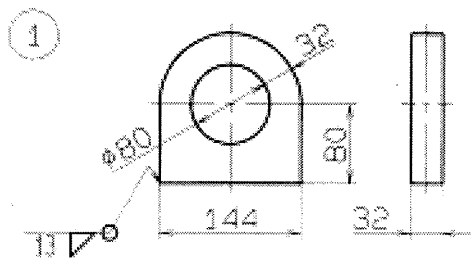


Fig.2-4-1 Lifting plate(for example)

①, ②, ③ : Load = 5 ton (JIS F3415)

④ : Load = 8.5 ton (JIS F3415)

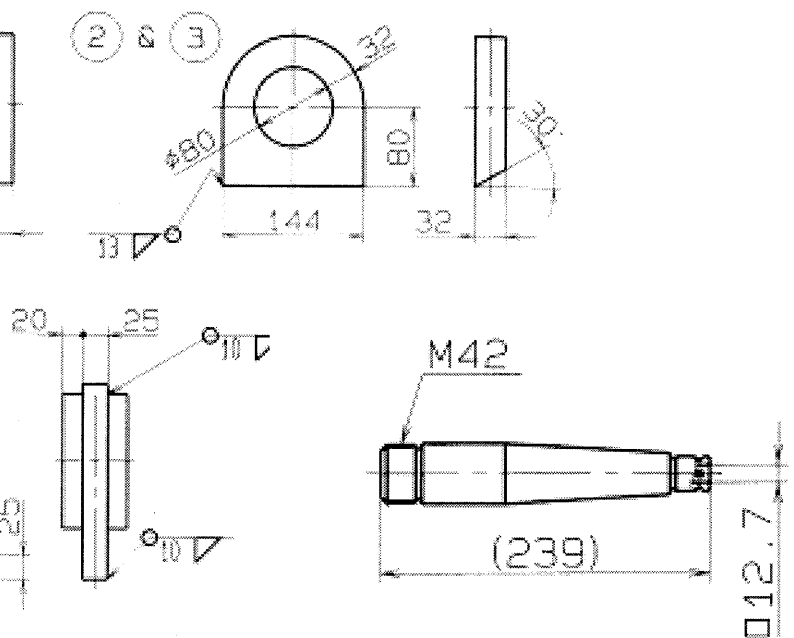


Fig.2-4-2 Guide bolt

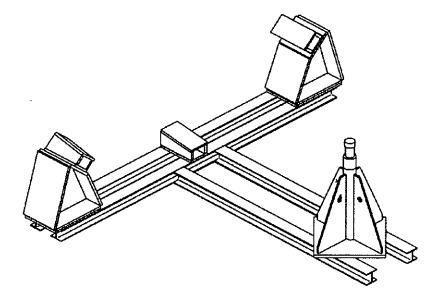


Fig.2-4-3 Stands for support lower unit  
(Example) – (Z41300001)

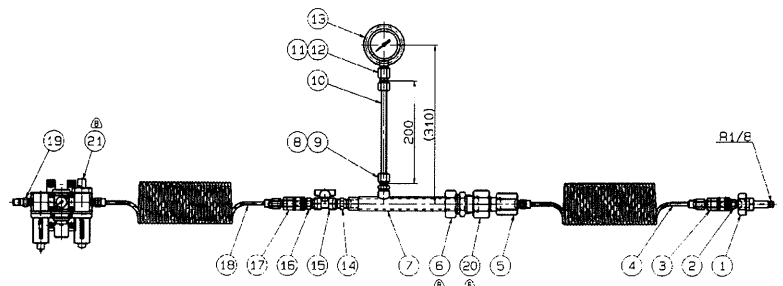


Fig.2-4-4 Air connector set for pressure test

### SECTION 3. INSTALLATION OF Z-PELLER

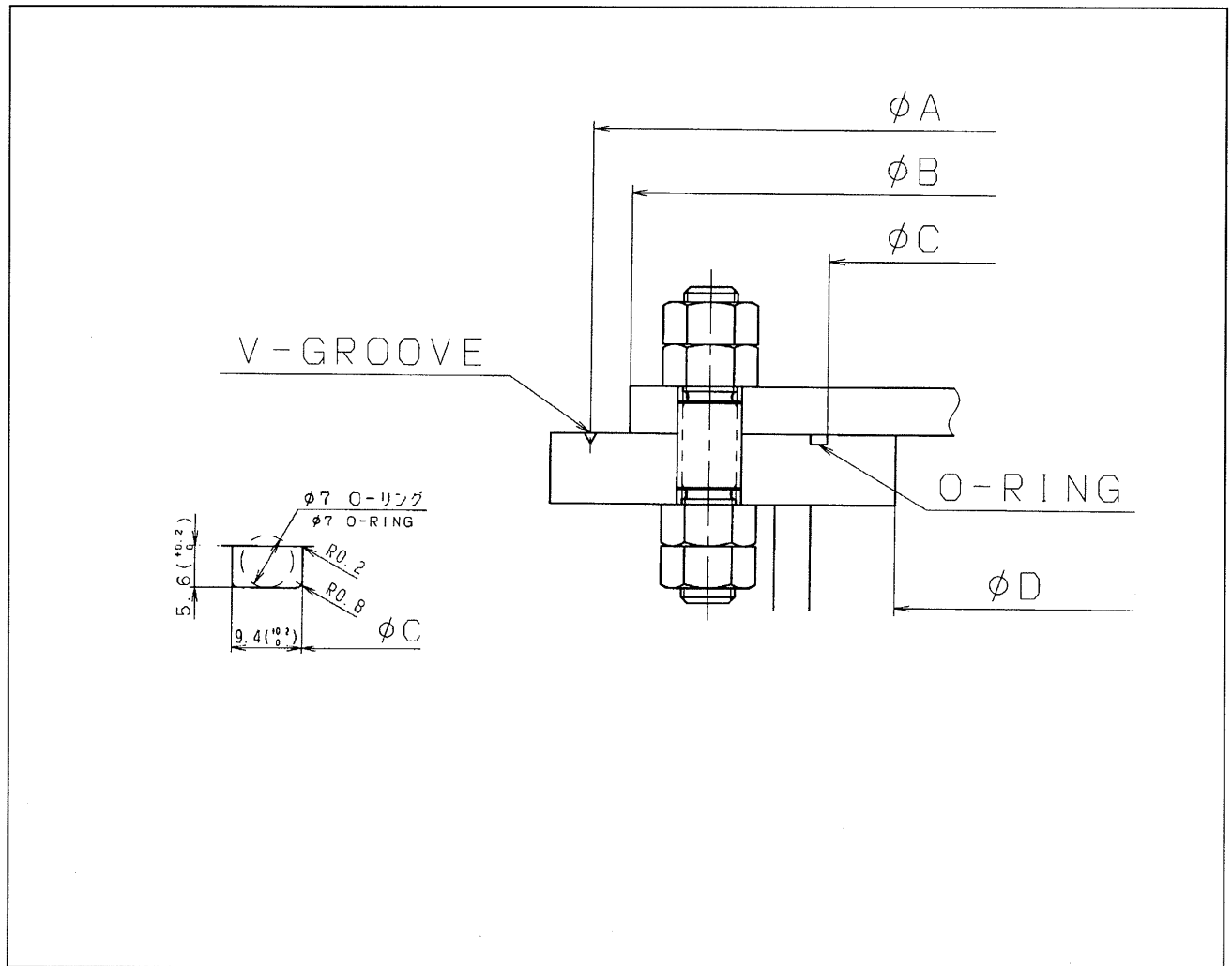
The following works including the preparation and provision of equipment and tools should be done by shipyard.

#### (1) Preparation before installation of Z-peller

- 1) After finish of welding for setting base, the upper face of setting base (ring) should be machined up within flatness  $\pm 0.5$  mm.
- 2) Cut the groove for O-ring on the upper face of setting base as shown in Fig. 3-1.
- 3) Cut the circumferential marks with V-groove on the upper face of setting base as shown in Fig.3-2 for the initial centering of Z-peller flange.
- 4) Mark the horizontal and longitudinal center line on upper face of setting base as shown in Fig. 3-2 for the initial centering of Z-peller flange.
- 5) After mounting Z-peller unit on setting base, it is checked by using a thickness gauge that there is a slightly open or not between the upper face of setting base and Z-peller flange in all around.  
If there is a clearance exceeding 0.5 mm, the upper face of setting base should be machined again.

#### (2) Positioning of Z-peller

- 1) After confirming the adhesion between the upper face of setting base and Z-peller flange, put O-ring as following procedure.
  - a) Cleaning in the O-ring groove.
  - b) Apply "Three Bond No. 1783" or "Silicon Sealant KE45" to the O-ring groove and the upper face of setting base.
  - c) Putting O-ring into Groove then Z-peller unit shall be mounted on setting base.
- 2) Four (4) side jacks are fixes on the horizontal and longitudinal center lines of setting base as shown in Fig. 3-3.
- 3) While the marks on Z-peller flange are met to the horizontal and longitudinal center lines on upper face of setting base, the tentative positioning for Z-peller unit shall be carried out as shown in Fig. 3-4.
- 4) Mating to bolt holes of Z-peller flange, drill the bolt holes of hull side.  
Note : The reaming for Z-peller unit should be carried out after confirming final alignment of shafting line up to main engine.
- 5) Bolt up Z-peller unit temporarily before launching.



Unit : mm

		ZP-41CP	ZP-41CP
A	Diameter of V-groove	φ3920	φ3320
B	Diameter of ZP flange	φ3900	φ3300
C	Inside dia. of O-ring	φ3700	φ3080
D	Diameter of hull opening	φ3600	φ3000

Fig. 3-1

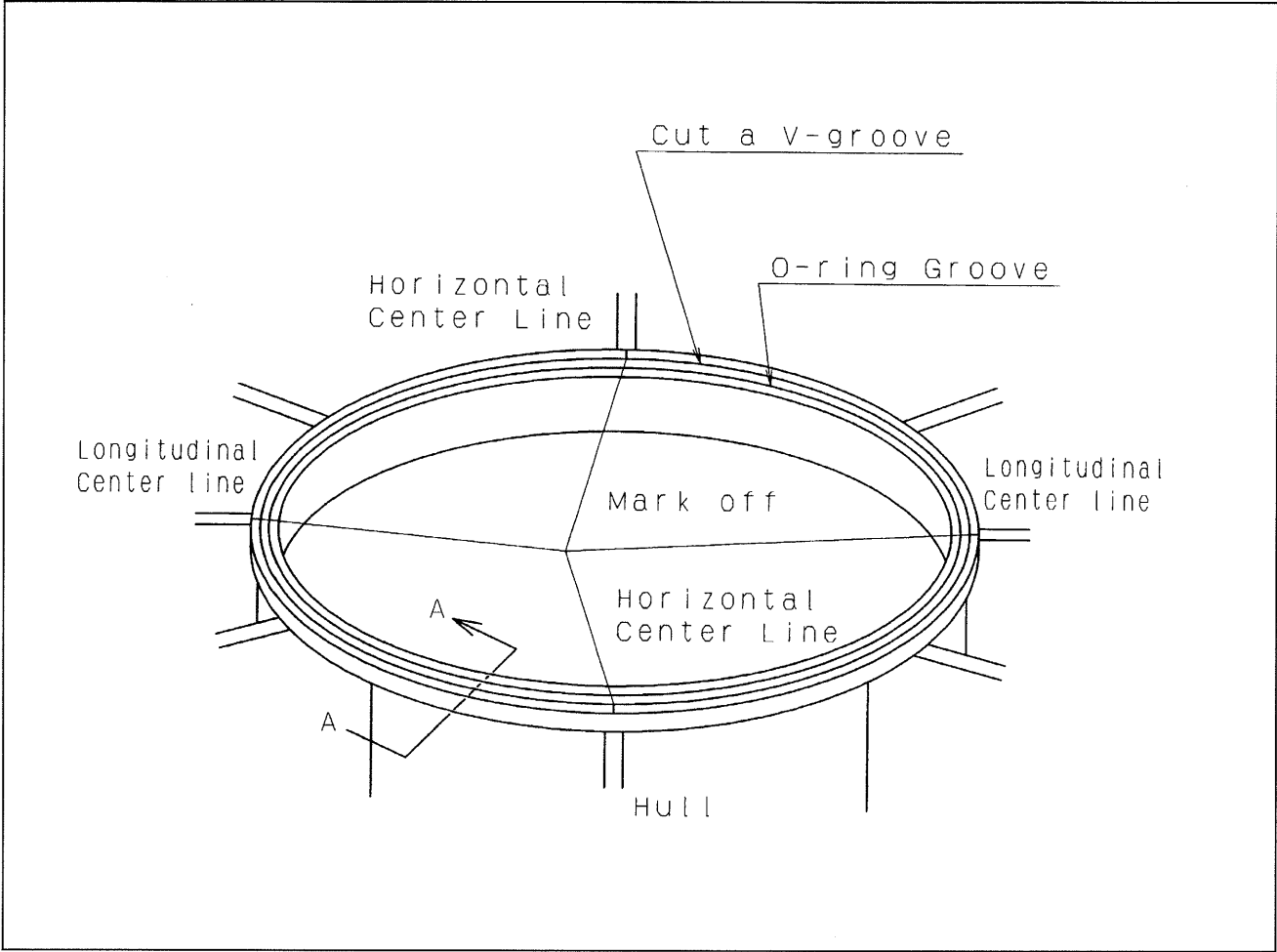


Fig. 3-2

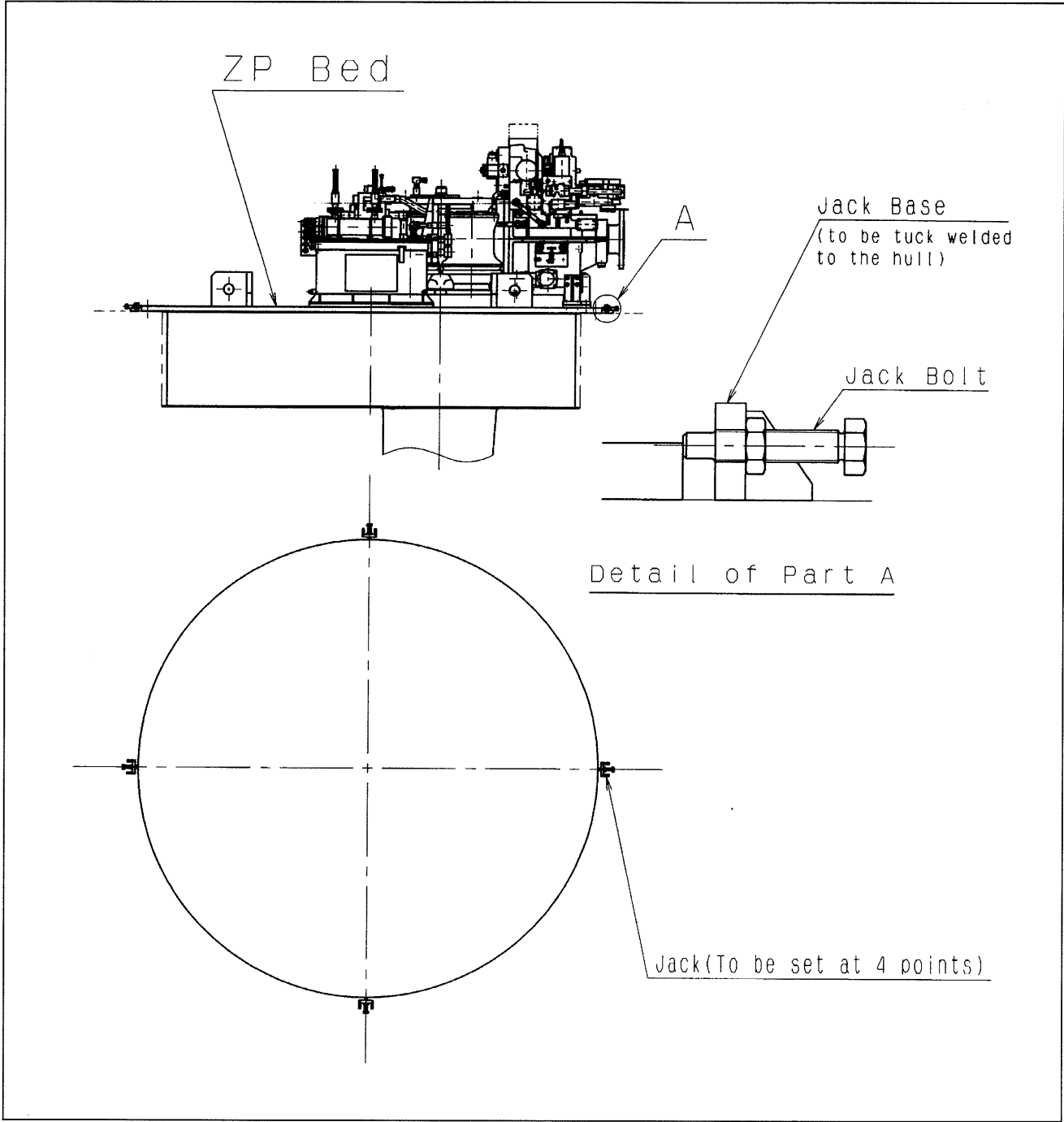


Fig. 3-3



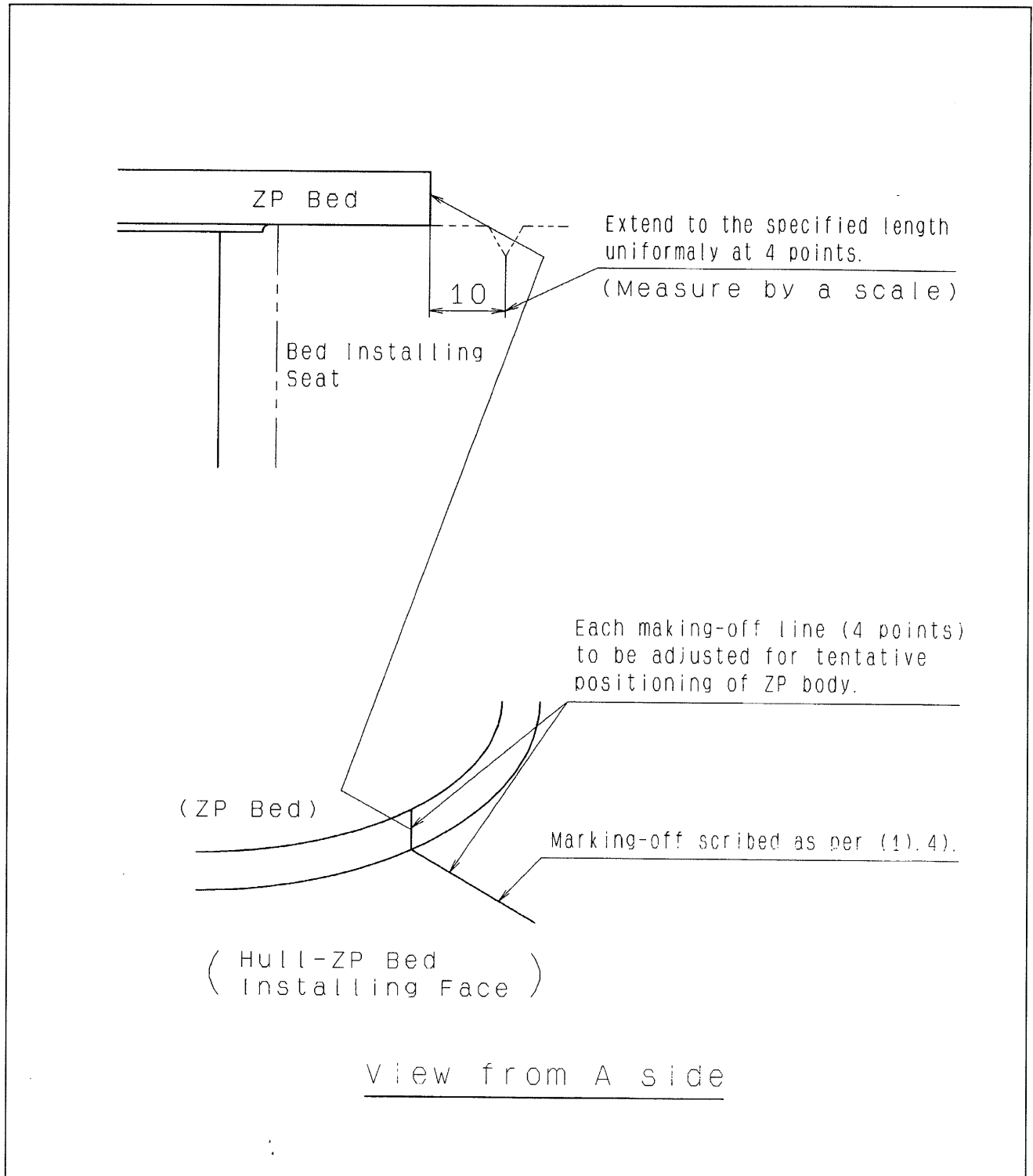


Fig. 3-4

(3) Disassemble upper unit and LO piping from middle unit to install lower unit and No.2 Vertical shaft

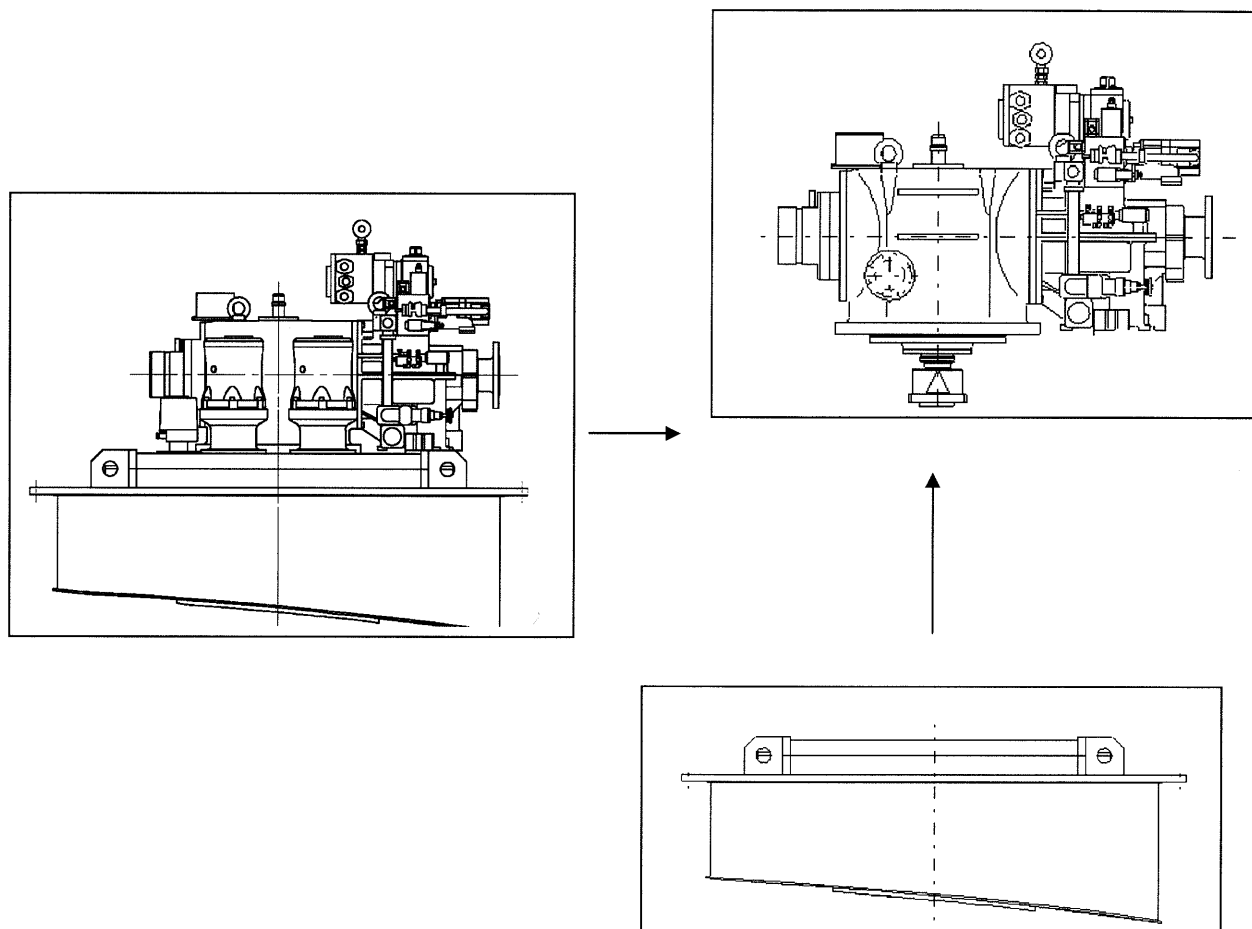


Fig 3-5

(4) Preparation to install Lower unit and feedback-chain to middle unit

- Set lower unit under middle unit and weld lifting plates and prepare chain-block and wires to lift up lower unit.
- Attach a thin long wire( more than 3m long) on the top of feedback-chain to lift up.
- Let this wire through the Fwd side hole of feedback-ring and oil-ring in middle unit. Be careful not to twist or drop feedback-chain.
- Attach CPP transmitter.

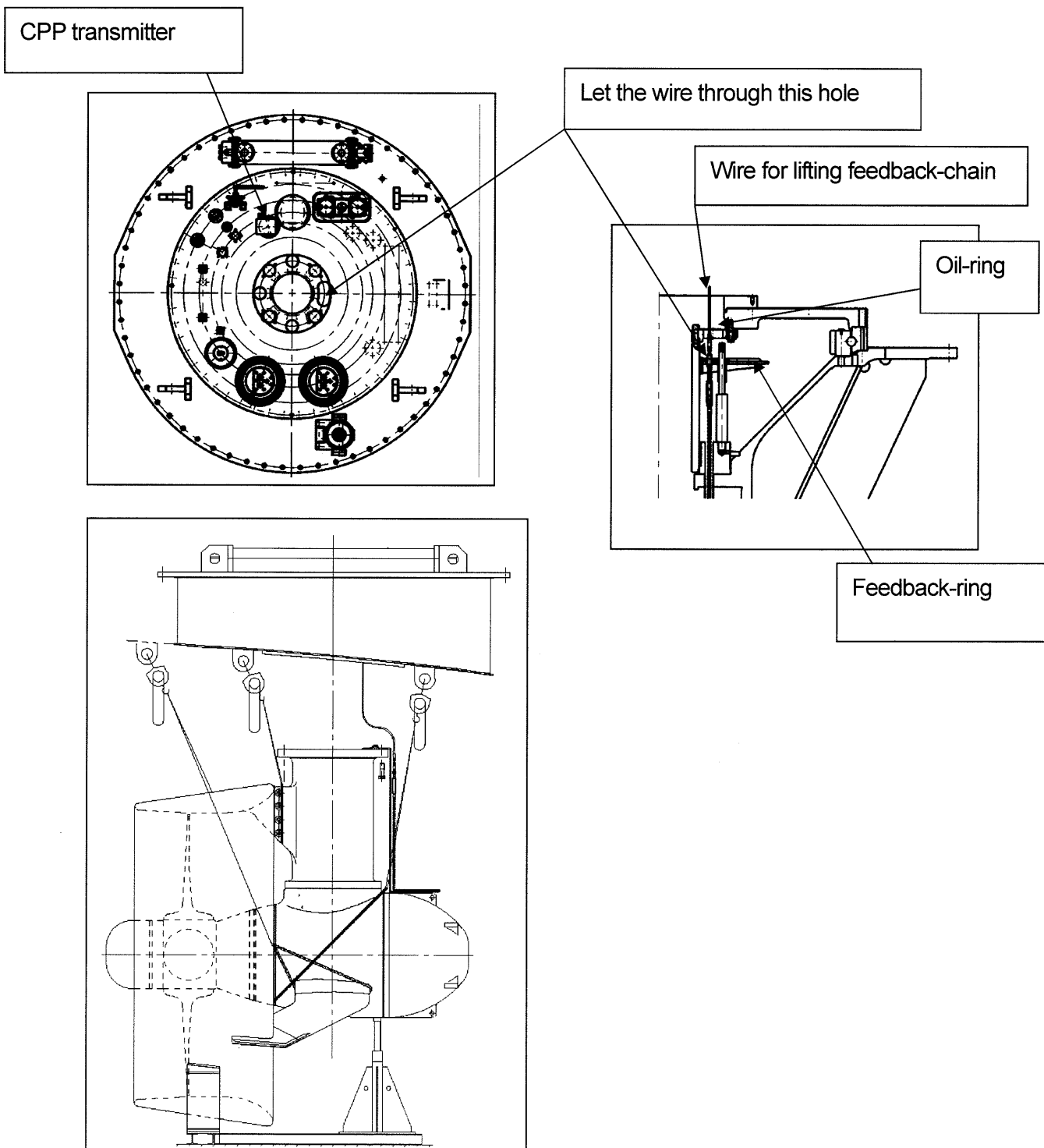


Fig 3-6

### (5) Install lower unit

- Attach 2 pieces of M20 long studs from Oil-ring and push down feedback-ring slowly. Check that pitch angle moves little by little on mechanical indicator of CPP transmitter. Set the indicator AHEAD 20 degree finally.
- Pull up feedback-chain and give tension. (Not loose it not to damage)
- Lift up lower unit slowly and keep pulling up feedback-chain.
- When close to the mounting flange of lower unit to middle unit, attach guide bolts.
- Fit and tighten bolts (20-M42) to attach lower unit.
- Attach lower parts of locking nut of feedback-chain and loosen M20 long studs slowly.
- Adjust locking nut so that the difference between propeller angle and mechanical indicator is less than one (1) degree.
- Tighten upper parts of locking nut and fix feedback-chain. Be careful not to move mechanical indicator, when tighten locking nut. After that, take out wire.

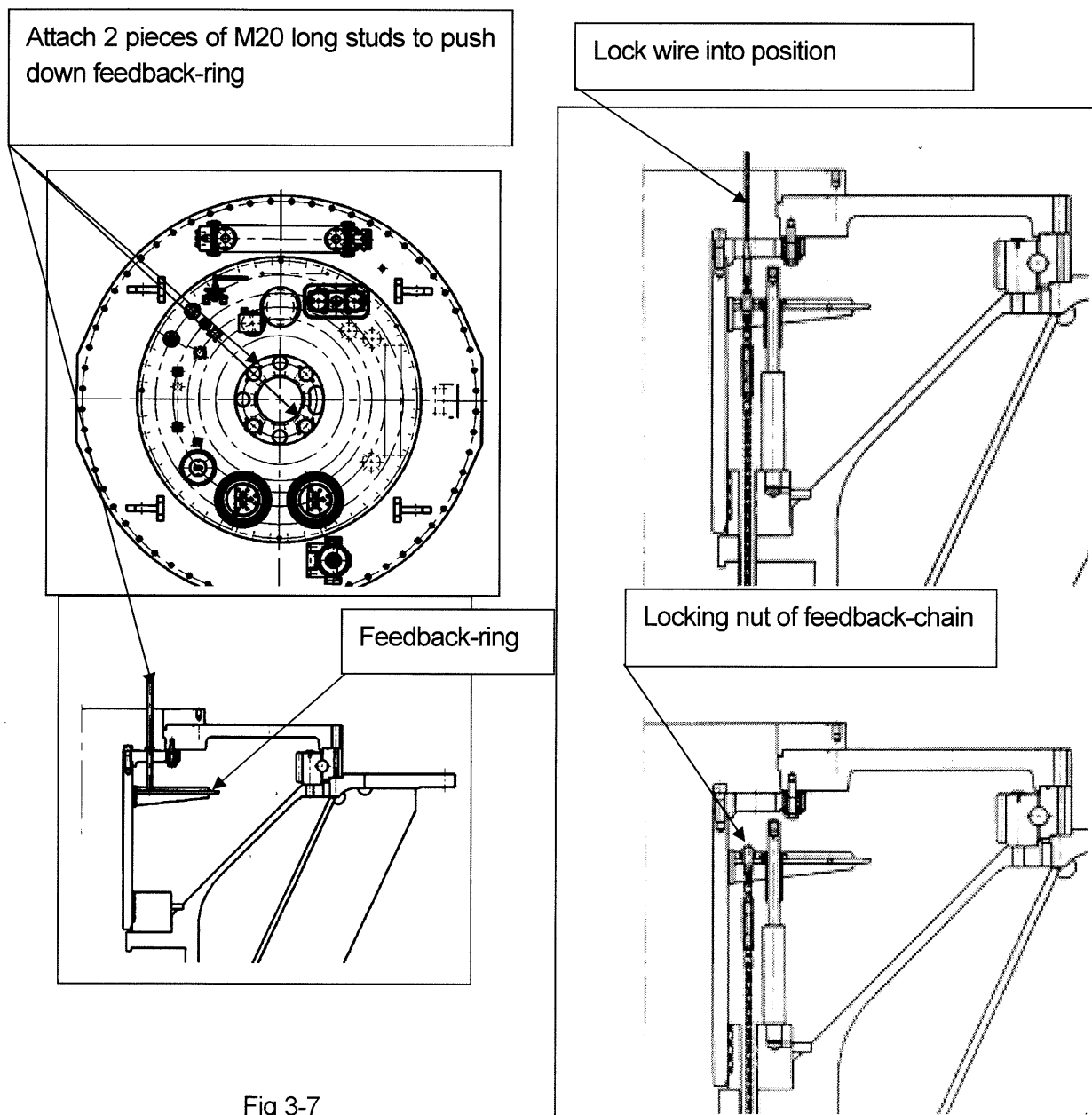


Fig 3-7

# (6) CPP air test

Check CPP movement by air before disassembly and after assembly

## 1) • Preparation

- Air connector in ZP special tool. ( Niigata D/N 99W67900B)
- Low pressure air. ( pressure is 0.6~0.8 MPa)
- Set pressure gauge (2.0 MPa), stop valve and connectors for air piping.

## 2) • CPP air test after assemble middle unit and lower unit.

- Fit the connector, pressure cage, stop valve and air piping to CPP port. Other side of CPP port should be opened.
- Supply air little by little and confirm to move CPP between full ahead and full Astern.
- Check CPP angle is the same as mechanical indicator of CPP transmitter. If there is some difference, adjust locking nuts of feedback-chain (Not drop) or angle plate of CPP transmitter.
- Pressure test

Position : full ahead or full astern

Set the pressure is 0.5MPa and close stop valve and hold for one (1) minutes.

Confirm that pressure does not drop to zero (0) within one (1) minute.

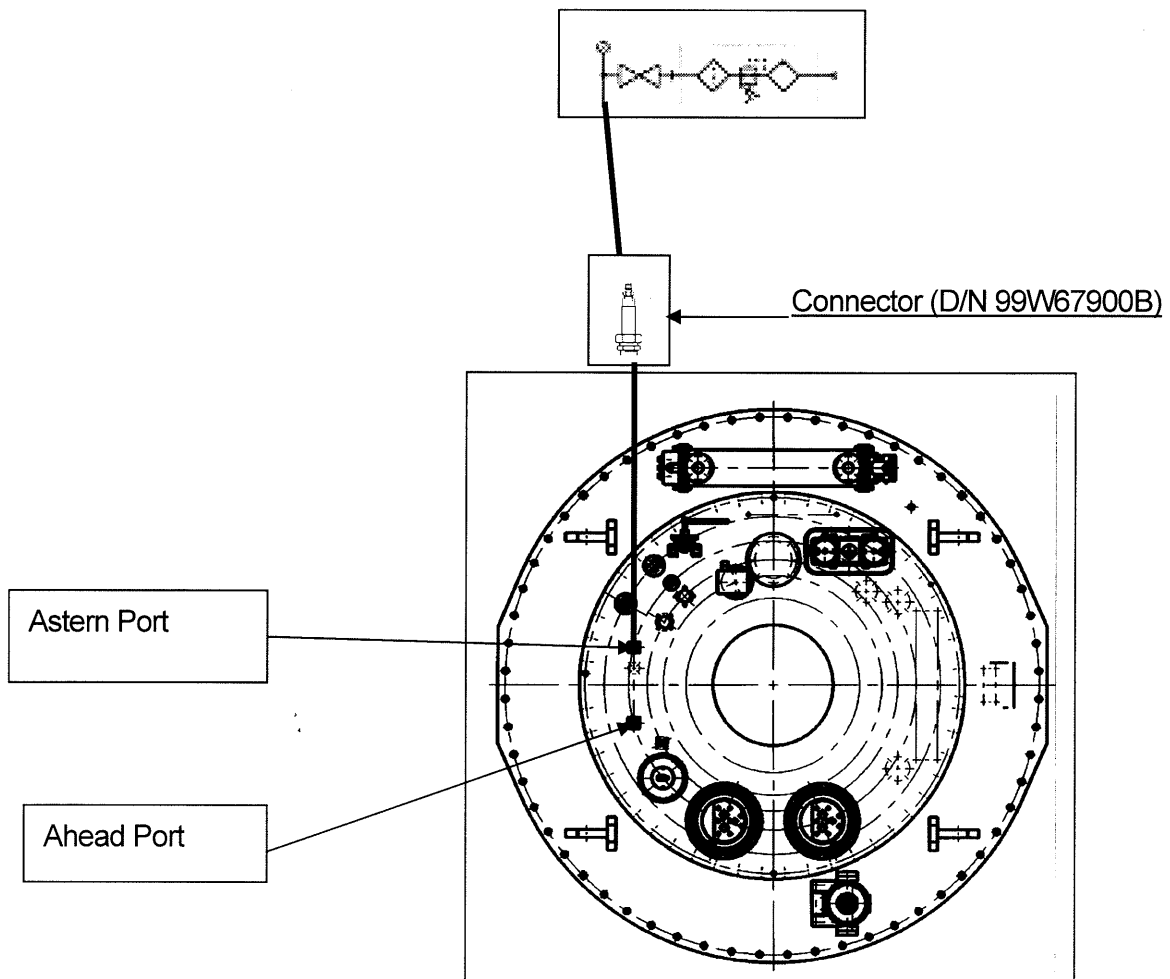


Fig 3-8

(7) Assemble of upper unit

Final assemble upper unit, LO piping and No.2 vertical shaft to lower unit

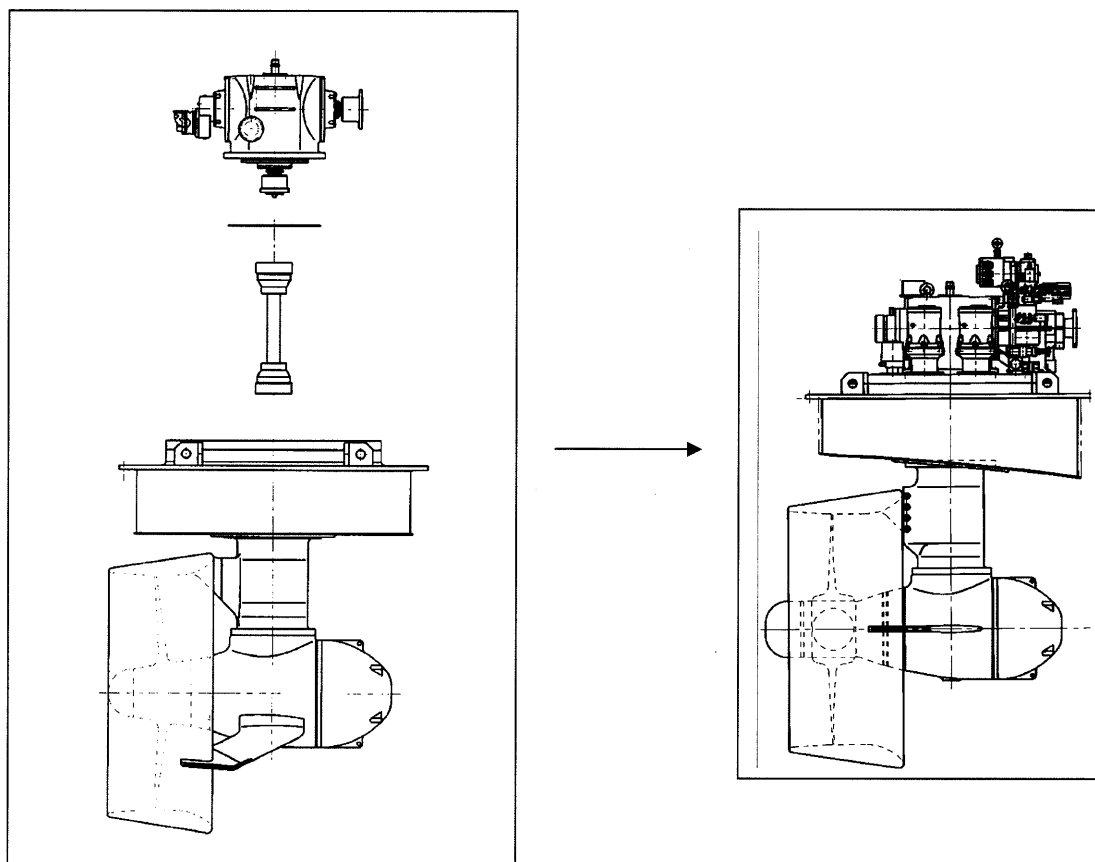


Fig 3-9

(8) Loading of lubricating oil

- 1) Lubricating oil shall be supplied by shipyard or owner.
- 2) Lubricating oil shall be selected and adopted from the recommended lubricant list in "Drawings and Documents" or "Instruction manual for Z-peller".
- 3) Lubricating oil shall be loaded from top of upper gear case after removing the cover plate.
- 4) Take out drain plug of propeller hub and confirm that lubricating oil come out from drain hole of propeller hub to exhaust air in the hub. After that close drain plug of propeller hub.
- 5) Oil level shall be checked by sounding bar at final step of loading,
- 6) Capacity of lubricating oil  
 Model ZP-41CP      Approx. 2500 liter/unit

Note : Lubricating oil for propeller shaft seal has been filled prior to delivery from manufacturer.  
 However, if not enough lubricating oil, which is same as engine oil (SAE), shall be added.

# (9) Pressure test of oil – tight inspection

- When supply lubricating oil, loose the plug of propeller hub and deflate air in the hub.
- Attach stop plate and stop ring for leakage test.  
(At air breathers, oil level gauge and input shaft seal housing)
- Apply air pressure from the top of upper unit and confirm no leakage from some flange and seal rings. (Pressure test 0.03 MPa)
- After pressure test, do not forget stop ring and plates.

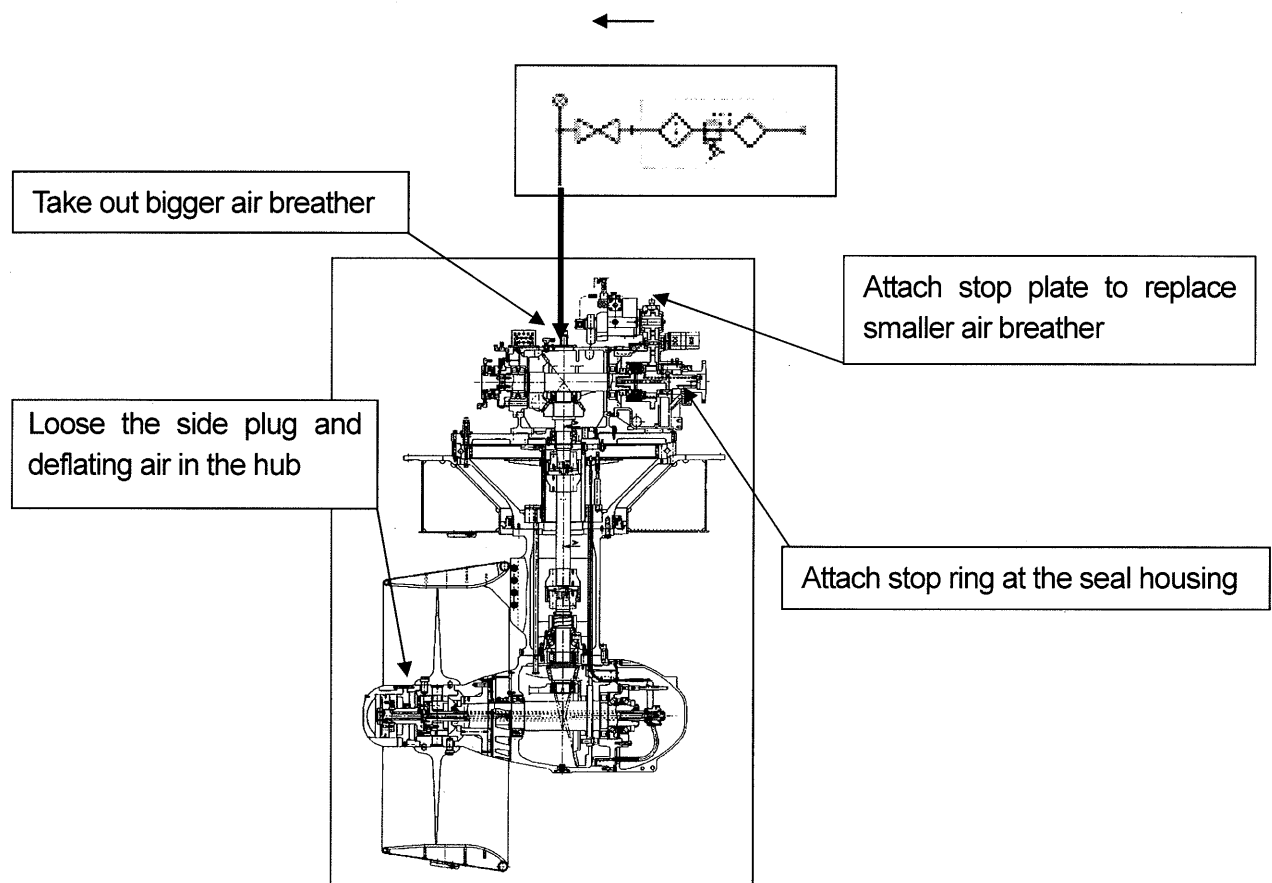


Fig.3-10



# (10) Deflation of propeller cylinder

Deflation of propeller cap with a maintenance pump.  
Confirm the level of L.O. after filling.

## -1) Start pump and operate CPP

After running, CPP pump is already connected and CPP can be operated by both remote control and manual operating. So After fill inside with lubricating oil and start CPP pump and move propeller pitch by non-follow or manual operating.

## -2) Preparations for piping between ZP and maintenance pump

When delivery ZP or overhaul CPP pump or some valve, CPP cannot be operated.

In such case, prepare the temporary piping as shown below with a special tools "Maintenance pump".

Fig3-11 is piping to move pitch to ahead direction.

When you move pitch to astern direction, replace piping of ahead port (Fig3-11 A) with astern port. (Fig3-11 B).

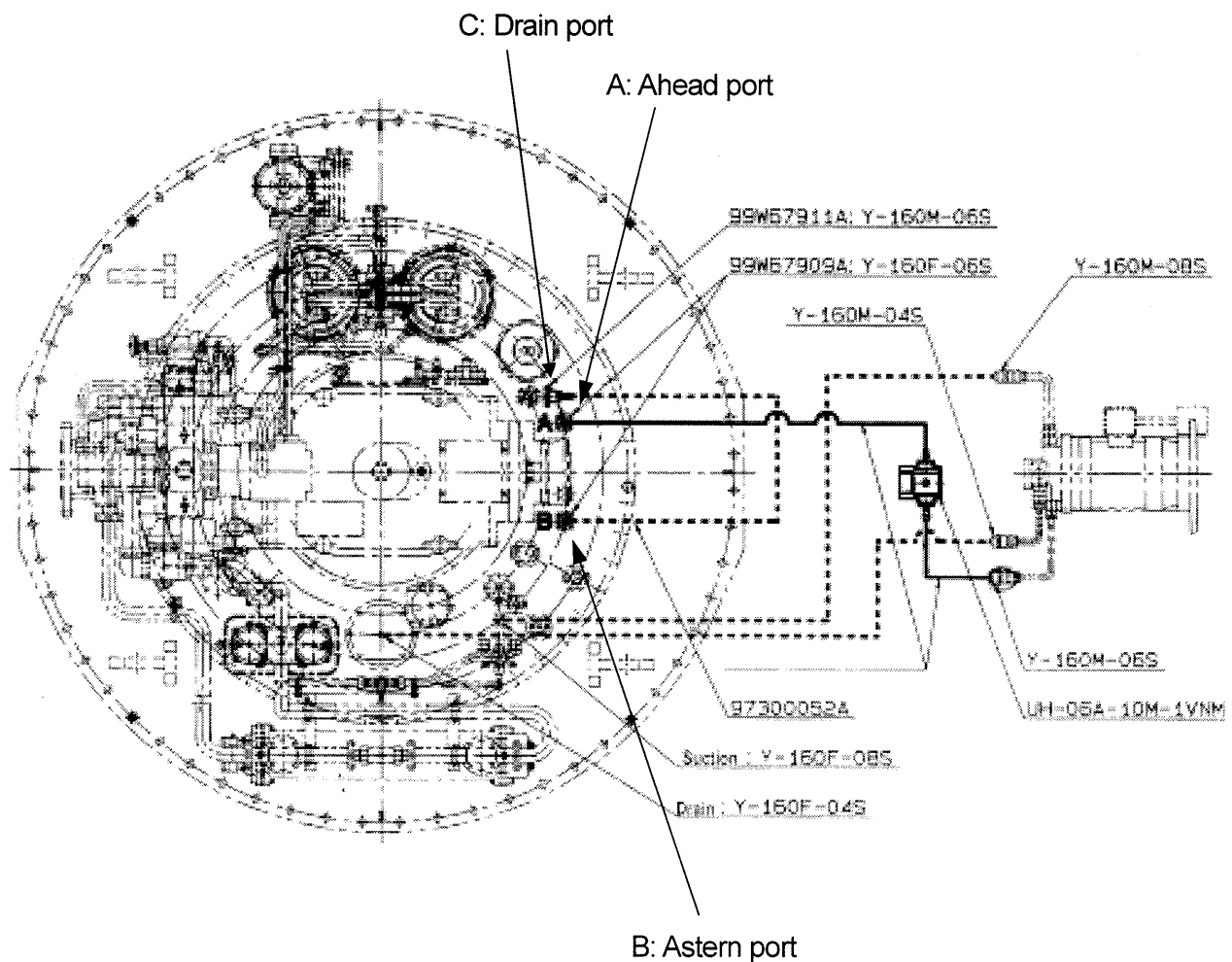


Fig.3-11

# (11) Preparations for propeller cap

Take out two pieces of taper plug and connect two pieces of deflation connector (99S67902A) at propeller cap.

Then, make a deflation connector come to the upper part by turning a propeller.

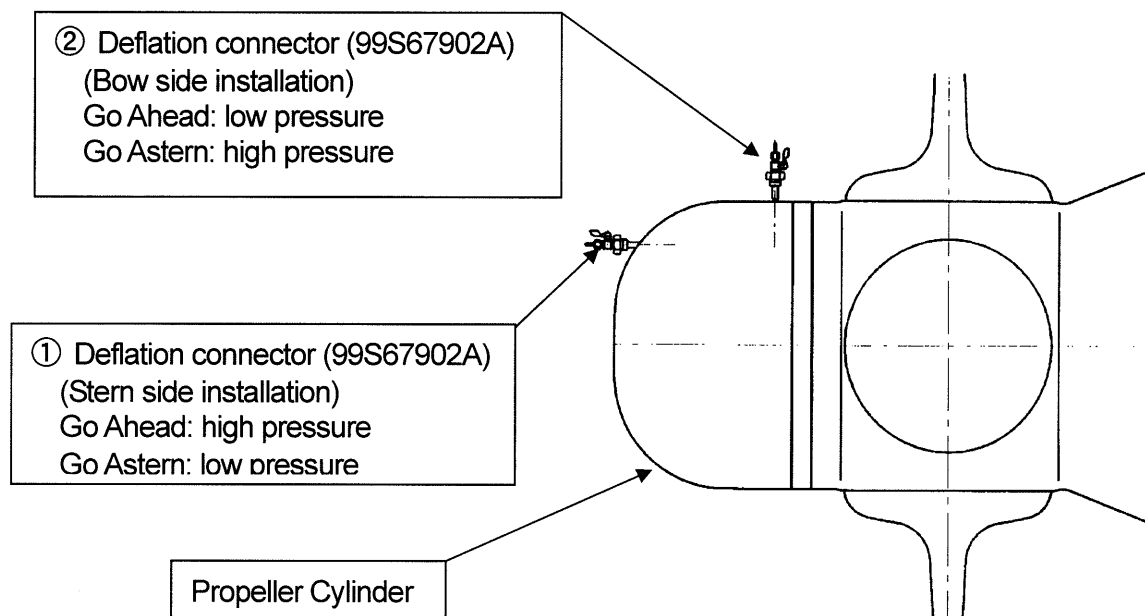


Fig.3-12

#### SECTION 4. TENTATIVE INSTALLATION

After the installation of Z-peller unit is completed, universal joint (Z-peller side), intermediate shafts (with bearings and couplings), universal joint (engine side), the preparation works should be carried out for alignment.

##### (1) Universal joint

- 1) The wide yoke of universal joint should be placed on the driving side (engine side = lower side) and the narrow yoke on driven side (Z-peller side = upper side) as shown in Fig. 4-1
- 2) The phase (position of cross-pin joint) of all yokes (on Z-peller side and engine side) should be placed in the same direction as shown in Fig. 4-1.

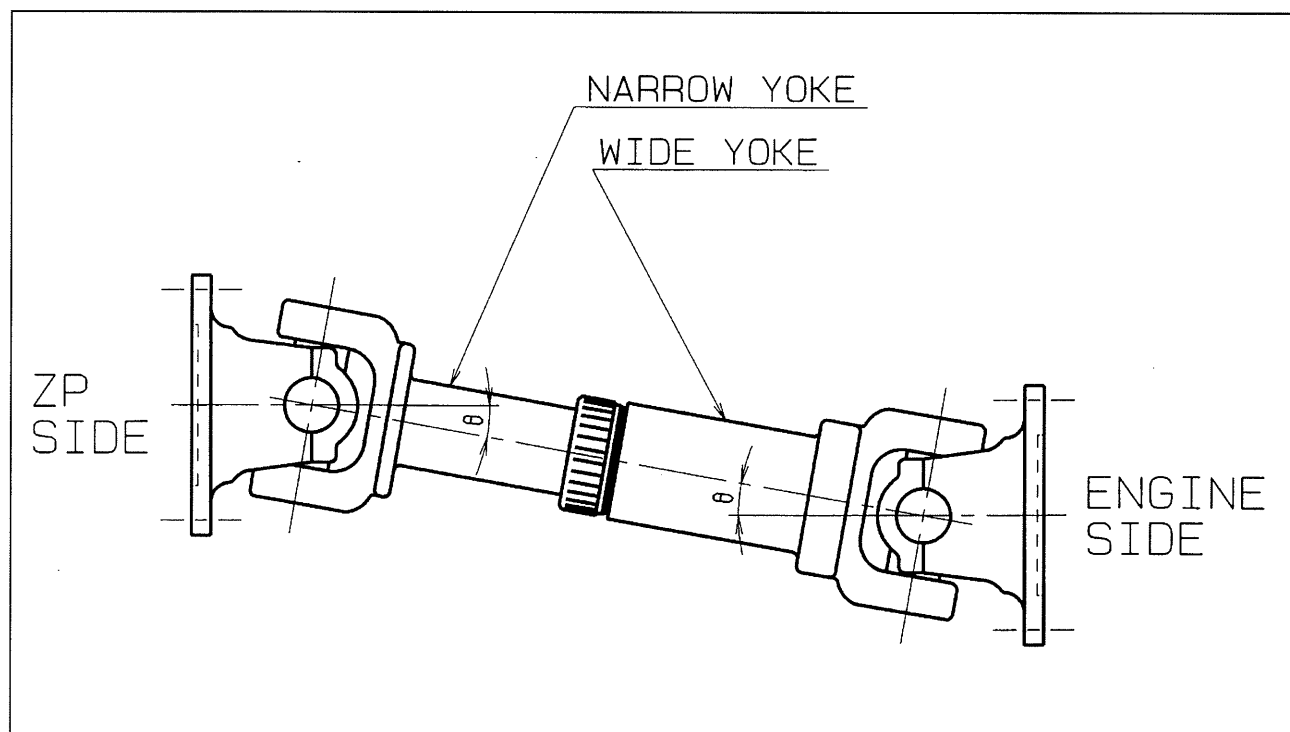
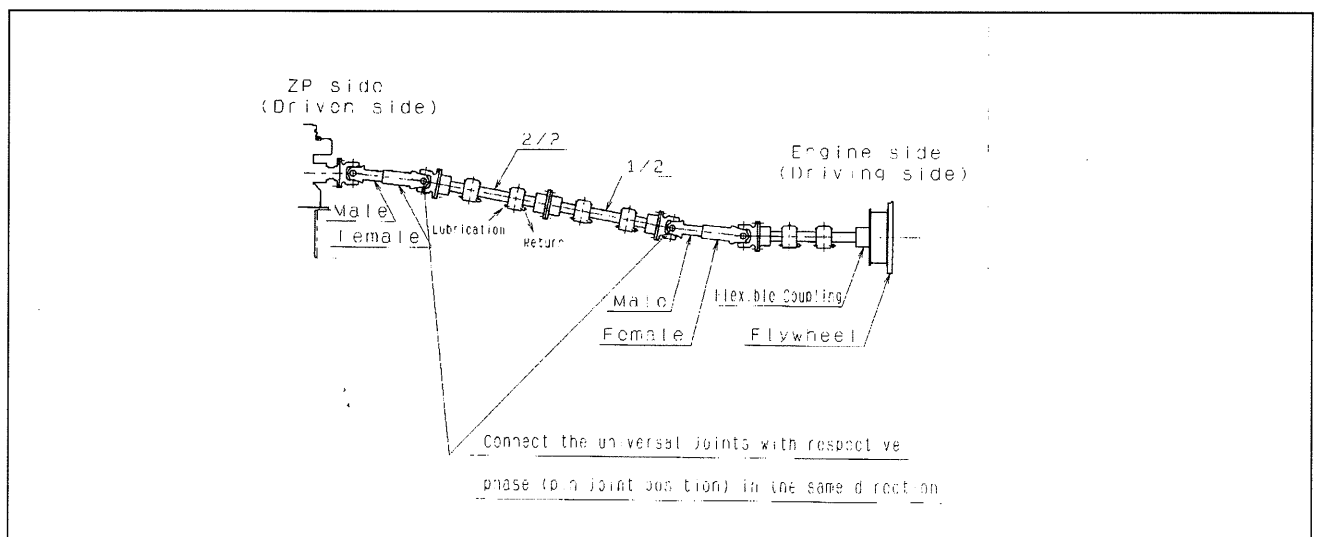


Fig. 4-1

## (2) Intermediate shaft

- 1) Each intermediate shaft is delivered in completed assemblage with bearings and coupling flanges.  
However, it should be carefully checked in order to be arranged in place and direction, such as Starboard, Port, bow (engine side) and stern (Z-peller side).
- 2) How to distinguish each intermediate shaft (Refer to Fig.4-2.)  
It is distinguished by Classification's stamps on circumference of coupling flange.
  - a) Distinguishing between Starboard and Port :  
Younger number of Classification's stamp means "Starboard unit".  
Elder number of Classification's stamp means "Port unit".  
For example :  
NK No. 751365 ... Starboard unit  
NK No. 751366 ... Port unit
  - b) Distinguishing between bow unit and stern unit :  
Younger sub-number of Classification's stamp means "Bow unit".  
Elder sub-number of Classification's stamp means "Stern unit".  
For example : (in case of Starboard unit)  
NK No. 751365 1/2 ... Bow unit  
NK No. 751365 2/2 ... Stern unit
  - c) Direction (engine side and Z-peller side) of installation :  
It is confirmed whether there is the stamp of survey date or not on circumference of coupling flange.  
Coupling flange with the stamp of survey date should be placed in engine side.



**Fig.4-2**

(3) Intermediate shaft bearing

The intermediate shaft bearing has already assembled with intermediate shaft at delivery from Niigata's Ohta works. Therefore, the arrangement and installation of bearings are carried out in accordance with the instructions mentioned in the side item (2).

1) Lubricating oil piping for bearings (Refer to Fig. 4-3.)

- a) Oil inlet pipe (φ 10 steel pipe) is connected at Z-peller side of bearing.  
Oil outlet pipe (SGP 15A) is connected at engine side of bearing.
- b) A small orifice (screwed up type) is incorporated with oil inlet port of bearing in order to adjust the flow rate of lubricating oil.
- c) Air vent pipe shall be provided with end of lubricating oil return pipes.

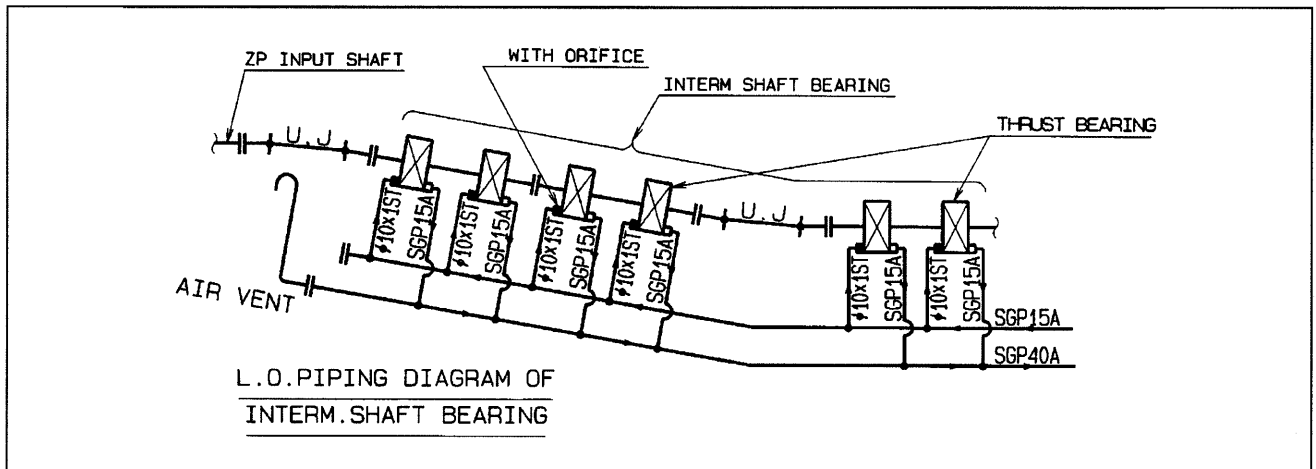


Fig. 4-3

(4) Main engine

How to distinguish each main engine.

It is distinguished by serial number of each unit.

- a) Distinguishing between Starboard and Port :  
Younger number of serial number means "Starboard unit".  
Older number of serial number means "Port unit".  
In addition to above, the name plates are fitted on each unit.
- b) Lifting manual for main engine (Refer to Fig.4-4)  
Lifting pieces are to be fitted on stud bolts of cylinder head.

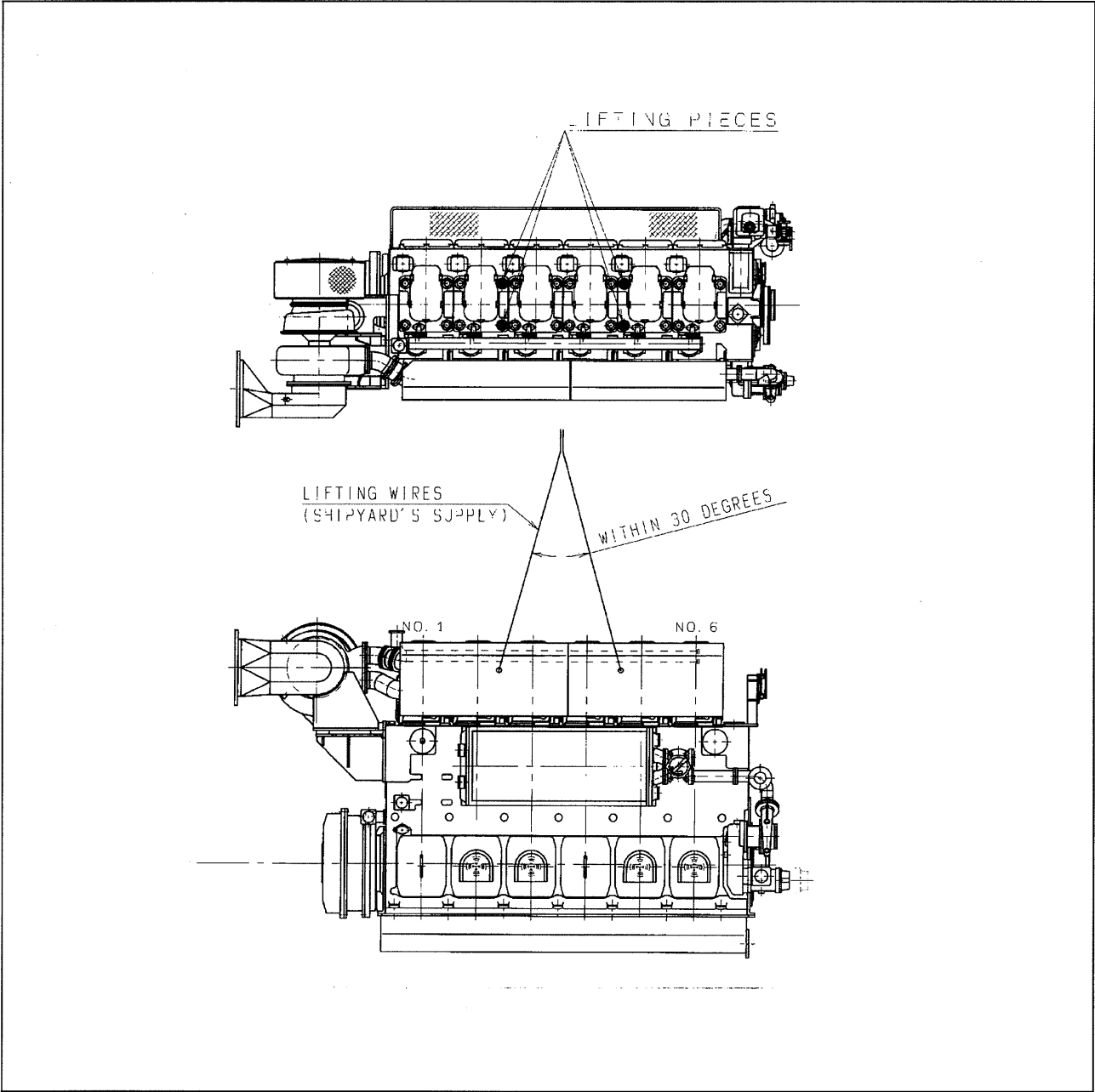


Fig. 4-4

## SECTION 5. ALIGNMENT OF EACH EQUIPMENT

### (1) Universal joint

When making the alignment of universal joint, take care of the following terms.

If any term shall be not satisfied, the vibration of universal joint is occurred or life of bearing of cross joint is affected due to unbalance of universal joint.

#### a) Tolerance of tilting angles;

##### I) Max. tilting angle

Model 95:  $\alpha_1 = \beta_1 \leq 8.0$  degrees,  $\alpha_2 = \beta_2 \leq 8.0$  degrees

##### II) Difference between actual angle and design angle

$\alpha_1, \beta_1, \alpha_2, \beta_2 \leq \pm 0.5$  degrees

##### III) Difference of angles between $\alpha_1$ and $\beta_1$ , $\alpha_2$ and $\beta_2 \leq 1$ degree

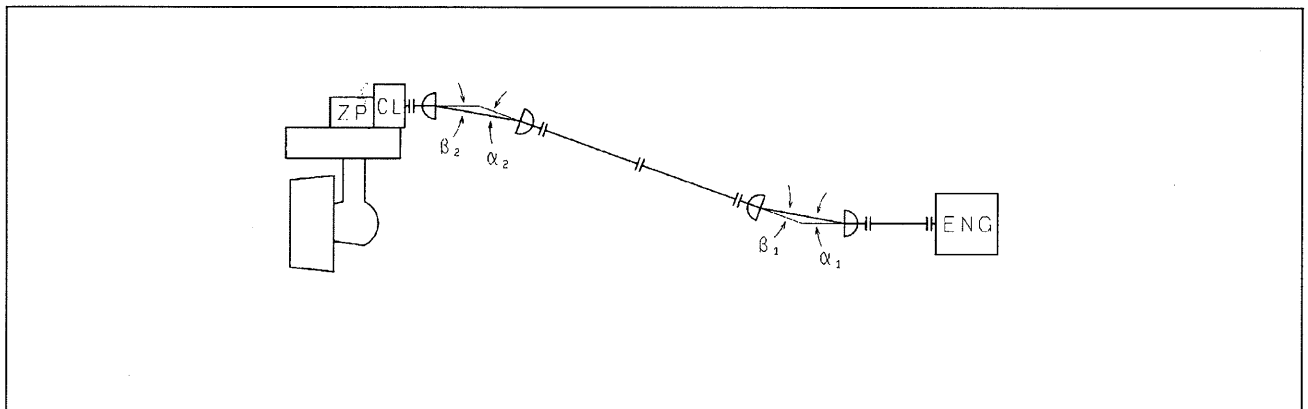


Fig. 5-1

#### b) Same phase;

Sleeve yoke (Bow side) and Spline yoke (Stern side) should be assembled on the same phase as shown in Fig. 5-2

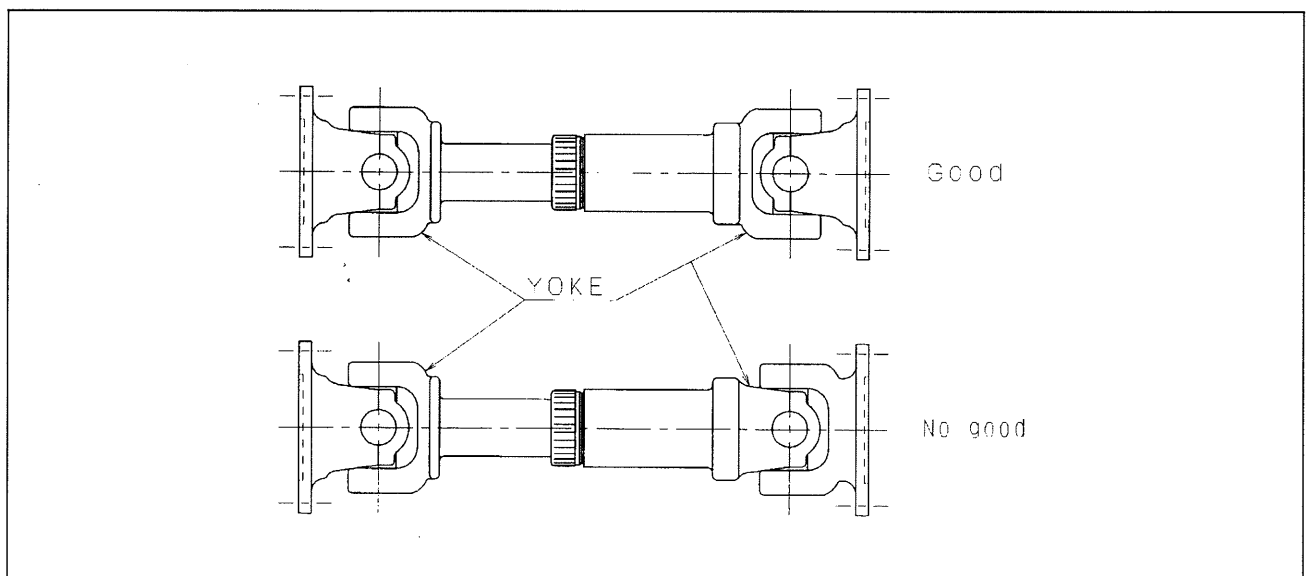


Fig. 5-2

# 1) Centering method of universal joint

When the centering of universal joint, centering tools to be used as shown in Fig. 5-3.

These centering tools should be prepared 2 pair sets for one shafting line by shipyard.

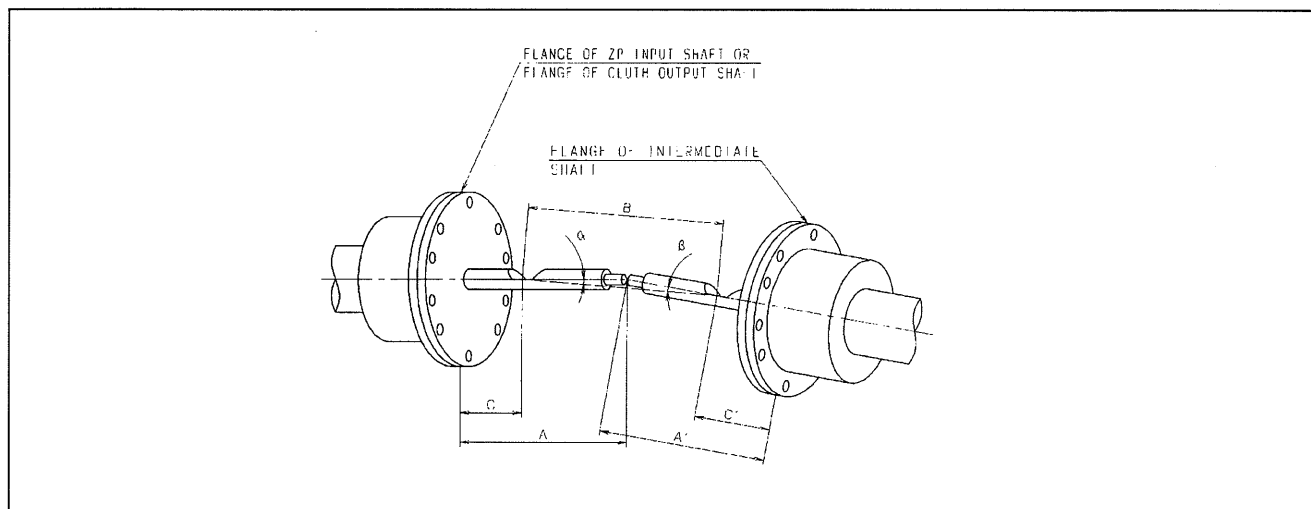


Fig. 5-3

- The center of centering tools should be a point of intersection.
- The distance A and A' should be equal.
- As the installation length, the actual length (B) between pins should be within  $\pm 10$  mm of the specified length.
- The tilting angle can be calculated by the following formula.

$$\cos \alpha = \cos \beta = \frac{B/2}{A-C}$$

Confirm that the calculated angles shall be in the following tolerance.

## I) Max. tilting angle

Model 95:  $\alpha_1 = \beta_1 \leq 8.0$  degrees,  $\alpha_2 = \beta_2 \leq 8.0$  degrees

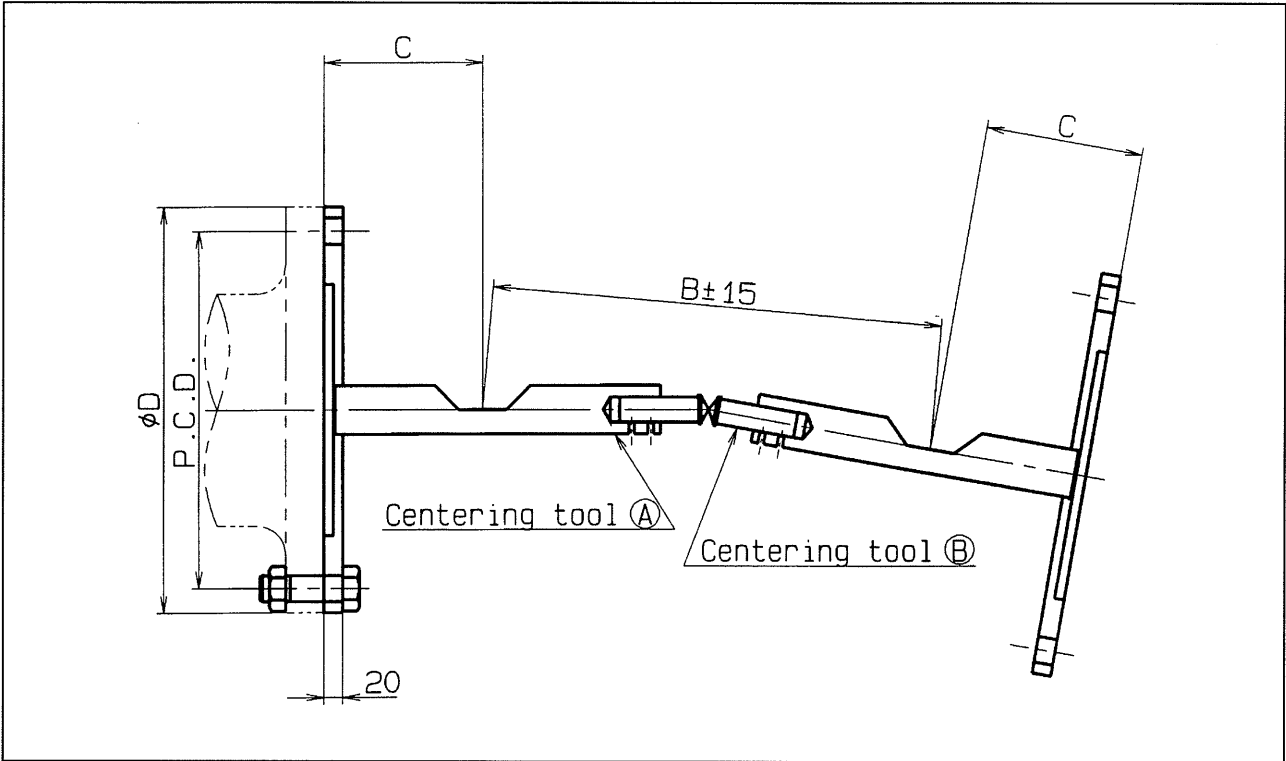
## II) Difference between actual angle and design angle

$\alpha_1, \beta_1, \alpha_2, \beta_2 \leq \pm 0.5$  degrees

## III) Difference of angles between $\alpha_1$ and $\beta_1$ , $\alpha_2$ and $\beta_2 \leq 1$ degree



- 2) Centering tools for universal joint  
The dimensions of centering tools are shown as follows (Fig. 5-4).



Model of Z-peller	ZP-41
Model of Universal joint	95
Drawing No. of tool A (Flange)	Fig. 5-5
Drawing No. of tool B (Pin)	Fig. 5-6

Fig. 5-4

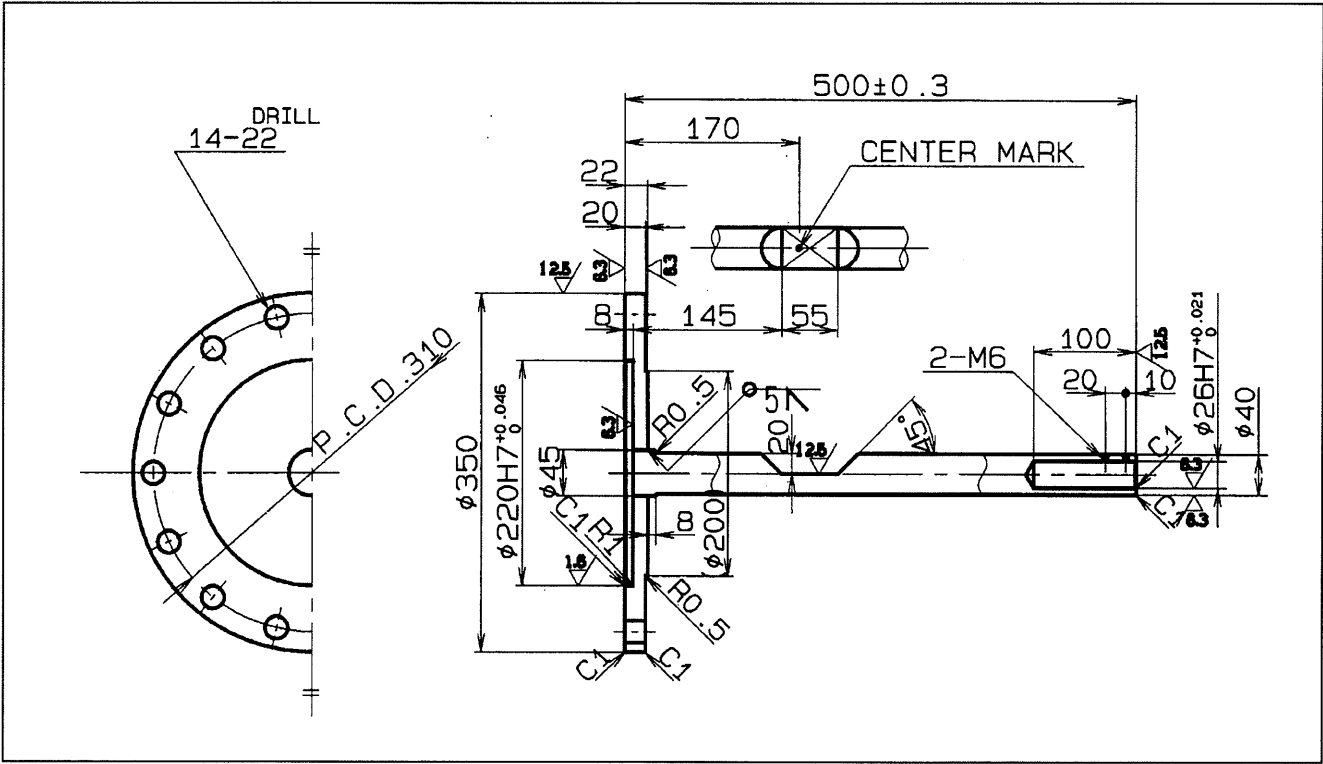


Fig. 5-5 (For model 95)

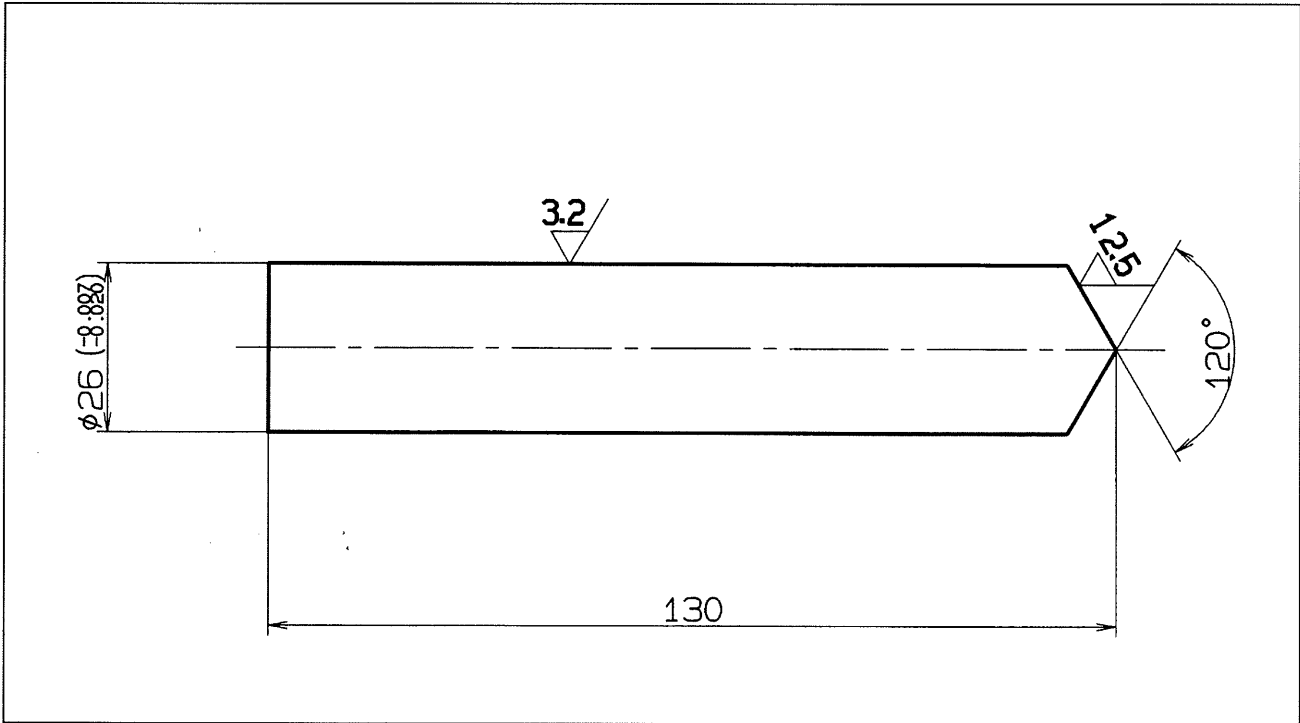


Fig. 5-6

(2) Measuring method of tilting angle

After mounting universal joint, actual tilting angles should be checked as final.

Tilting angles of universal joint can be checked by measuring the distance between each position on flange, fork yoke.

- 1) Turning universal joint, maximum distance between each position to be measured with compass or slide caliper.
- 2) The measured maximum distance can be converted into tilting angle by using the conversion table of distance - angle. (Refer to Fig. 5-7 and 5-8.)
- 3) For the confirmation, minimum distance between each position should be checked.

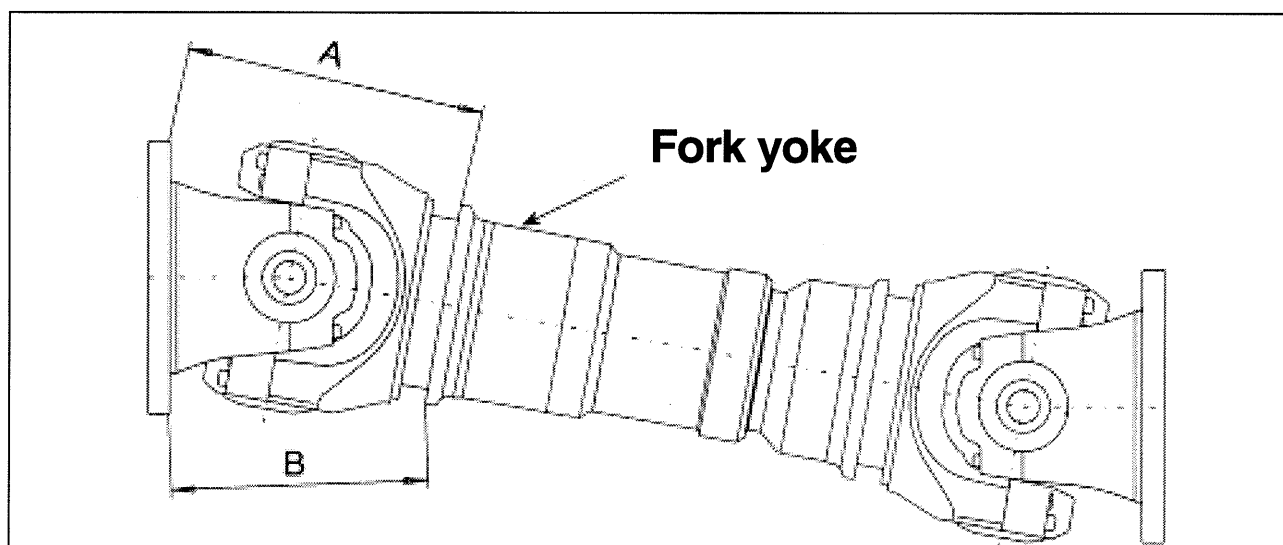


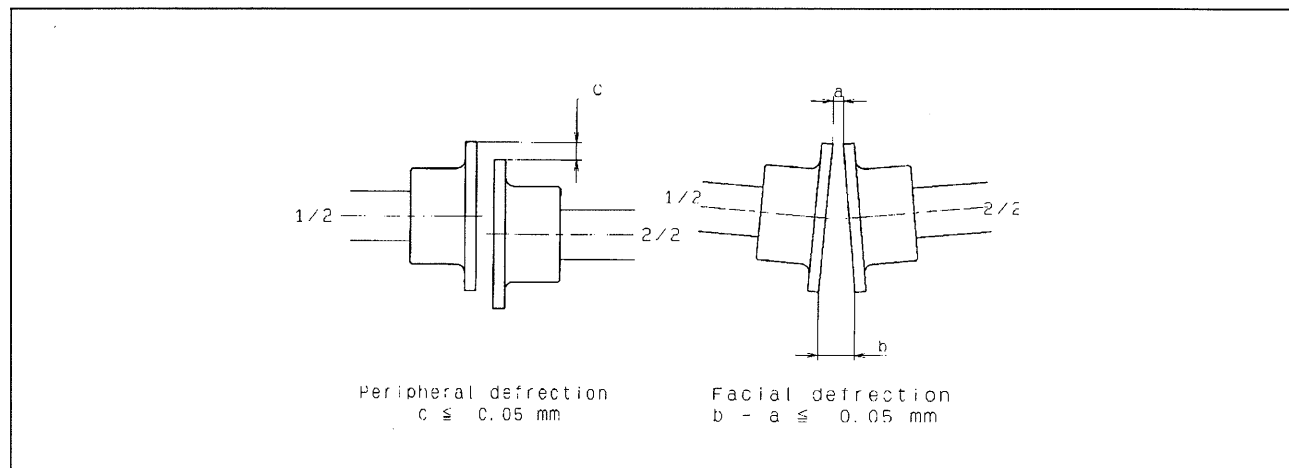
Fig. 5-7

CONVERSION TABLE OF DISTANCE – ANGLE			
MODEL OF UNIVERSAL JOINT	95		
DEFLECTION ANGLE [ deg. ]	LENGTH A [ mm ]	LENGTH B [ mm ]	DIFFERENCE A-B [ mm ]
0	326.85	326.85	0.0
0.5	328.16	325.53	2.63
1	329.47	324.20	5.26
1.5	330.77	322.87	7.89
2	332.06	321.54	10.52
2.5	333.35	320.19	13.16
3	334.63	318.84	15.79
3.5	335.90	317.49	18.42
4	337.17	316.13	21.05
4.5	338.43	314.76	23.67
5	339.69	313.38	26.30
5.5	340.94	312.01	28.93
6	342.18	310.62	31.56
6.5	343.42	309.23	34.19
7	344.65	307.83	36.81
7.5	345.87	306.43	39.44
8	347.08	305.02	42.07
8.5	348.29	303.60	44.69
9	349.50	302.18	47.31
9.5	350.69	300.76	49.94
10	351.88	299.33	52.56
10.5	353.07	297.89	55.18
11	354.24	296.45	57.80
11.5	355.41	295.00	60.42
12	356.58	293.54	63.03
12.5	357.73	292.08	65.65
13	358.88	290.62	68.26
13.5	360.02	289.15	70.88
14	361.16	287.67	73.49
14.5	362.29	286.19	76.10
15	363.41	284.70	78.71

Fig. 5-8

### (3) Intermediate shaft

The peripheral and facial deflection of coupling of intermediate shaft 1/2 (bow side) and 2/2(stern side) should be within 0.05 mm as tolerance. (Refer to Fig 5-9)



**Fig. 5-9**

### (4) Geislinger coupling

- 1) According to Geislinger Installation manual.

(5) Chock liner

Insert all chock liner for intermediate shaft bearings and main engines after machining and necessary adjust of them.

For final adjustment of chock liner, it is recommended to apply a thin coat of red lead to the contact surface.

Niigata shall supply the chock liners of casting iron. (FC)

If less than 25mm, change to the chock liners of steel plate (SS400) provided by shipyard.

(6) Reaming

Drill and ream up each bolt's holes for all equipments.

(7) Foundation bolts

All foundation bolts(Non-fit bolts and reamer bolts) to be set and tightened securely.

(8) Final checking

Check alignment, deflection and etc. for all equipments to be within allowable tolerance and values as final.

## APPENDIX CHECK SHEET AND RECORD TABLE

## (1) Check sheet

Customer

M/E Type

M/E No

ZP Type

ZP No

Measured by :

No.	Check item	Date	Remarks
1.	Have the centering of shaft systems been recording?	/	Fill in the record table
2.	Have the dimension of doubling plates and chock liners been recorded?	/	"
3.	Have the distance between the innerstar flange and the lateral plate of the geislinger been recorded?	/	"
4.	Has the installation angle of the universal joint been recorded? Yes (The difference between the installation angle of one joint and that of other be within 1 deg.)	/	"
5.	Have the universal joint been placed in the correct rotation direction? (Is the female spline placed on the driving side?)	/	
6.	Has the phase (pin joint position) of the ZP side universal joint been the same as that of the engine side universal joint?	/	
7.	How much is the hull distortion of the ZP bed installing face in mm?	/	
8.	Is each intermediate shaft arranged on the correct side?	/	
9.	Is the intermediate shaft bearing assembled in the right? Is the intermediate shaft bearing in uniform contact with the intermediate shaft?	/	
10.	Is the oiling pipes of the intermediate shaft bearing correctly equipped?	/	
11.	Is the intermediate shaft bearing base rigged enough? Is the intermediate shaft bearing base perfectly welded to the rib of the hull?	/	
12.	Has lubrication been made prior to boarding on ship?	/	

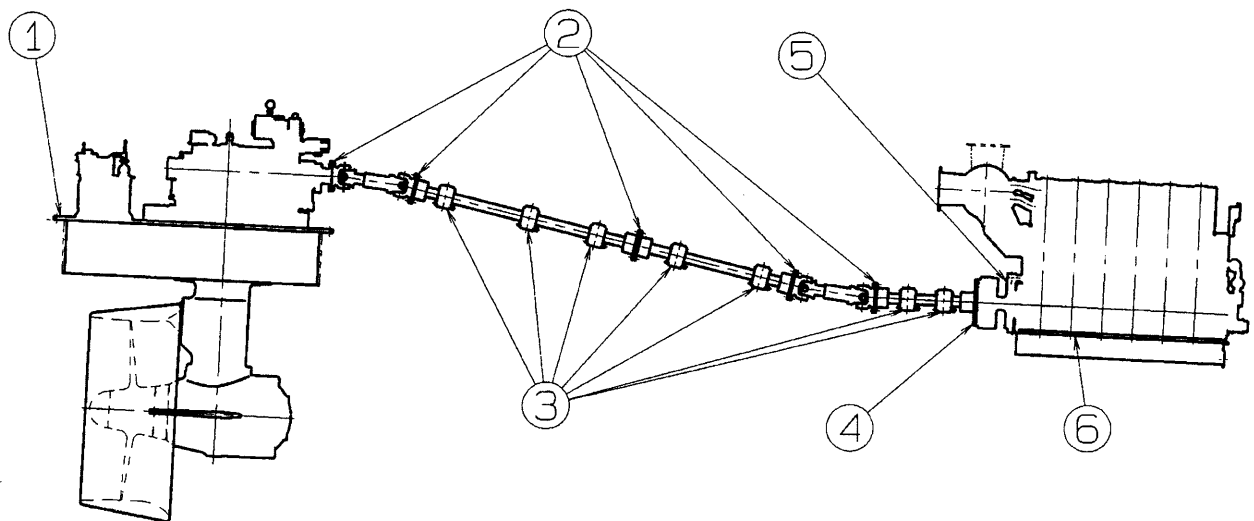
No.	Check item	Date	Remarks
13.	Have the clutch and engine reamer bolts satisfied the specifications? Yes No: × places	/	
14.	Are there any undesirable bends or air pockets in the pilings?	/	
15.	Have debarring and picking treatment of site welding piping completed?	/	
16.	Has flushing completed for site piping work? Yes duration of flushing : hrs Oil used :	/	
17.	Have the follow-up of subjects appointed by the Evaluation Record of the Official trial test the conclusions confirmed together been completed? Yes No:	/	
18.	Have spare parts and tools been checked? Witnessed by : Parts or tools short :	/	
19.	Requests and communication to chief Engineer		
20.	Requests and communication to the shipyard		
21.	Communication to the test operator :		
22.	Customer's requests :		
23.	Parts to be delivered at a later date:	/	
24.	Has the Sales Office been notified of the complication of the installing work? Modified: Mr. of Section.	/	
25.	Others:	/	



## TIGHTENING TORQUE TABLE

No.	Connecting position	Bolt size	Tightening torque
①	ZP unit and hull side	M30	588 N-m Apply machine oil
②	ZP unit and universal joint	M22	550 N-m Apply machine oil
	Universal joint and shaft		
	Shaft and shaft		
	Shaft and universal joint		
③	Bearing and hull side	M27	422 N-m Apply machine oil
④	Shaft and Geislinger coupling	M42	2059 N-m Apply molykote(MoS2)
⑥	Geislinger coupling and flywheel	M27	588 N-m Apply molykote(MoS2)
⑦	Engine and hull side	M39	1186 N-m Apply machine oil

NOTE) In case of chockfast, the another calculation for tightening torque is necessary.





# INSTALLATION RECORD TABLE

PORT SIDE · STARBOARD SIDE

NAME OF SHIP: \_\_\_\_\_ CUSTOMER: \_\_\_\_\_

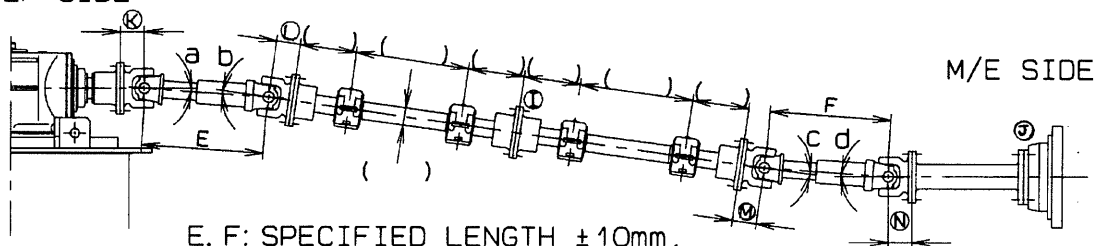
MEASURED BY: \_\_\_\_\_ DATE: . . .

M/E MODEL: \_\_\_\_\_ M/E NO: \_\_\_\_\_

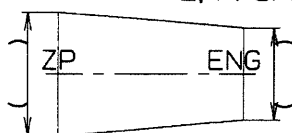
ZP MODEL: \_\_\_\_\_ ZP NO: \_\_\_\_\_

## 1. CENTERING OF THE UNIVERSAL JOINT AND SHAFTING.

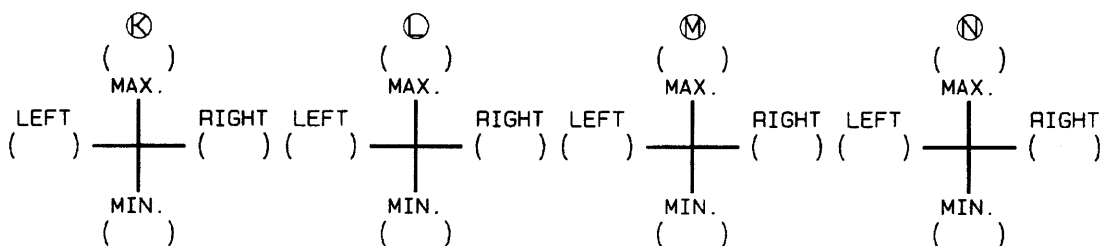
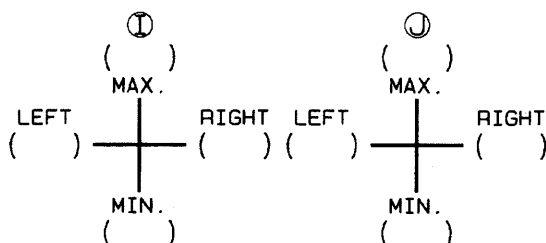
ZP SIDE



E, F: SPECIFIED LENGTH ±10mm.



a	b	c	d	E	F
				m/m	m/m



## 2. CLEARANCE BETWEEN THE CRANK JOURNAL AND MAIN BEARING. (MEASURED BY FILLER GAUGE UNIT: 1/100mm)

NO.	1	2	3	4	5	6	7	8	9	THRUST CLEARANCE
DIRECTION										
HEAD SIDE										
STERN SIDE										



INSTALLATION RECORD TABLE

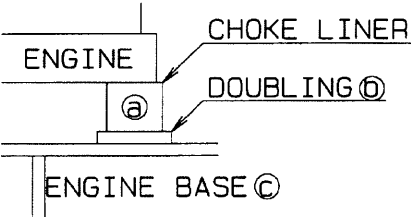
PORT SIDE-STARBOARD SIDE

3. CRANKSHAFT DEFLECTION ENGINE CONDITION AT TIME OF MEASUREMENT.  
(RECORD THE DIAL GANGE READING AS IT IS UNIT: 1/100mm)  
NOTE: ( ) INDICATE THE CRANKPIN POSITION.

1	2	3	4	5	6	7	8
( )	( )	( )	( )	( )	( )	( )	( )
( )	( )	( )	( )	( )	( )	( )	( )
( )	( )	( )	( )	( )	( )	( )	( )

4. ENGINE BASE DIMENSIONS. (UNIT: mm)

ITEM	MEASURING POINT	ENGINE	
		HEAD SIDE	STERN SIDE
CHOKE LINER	Ⓐ		
DOUBLING	Ⓓ		
ENGINE BASE	ⓒ		
NUMBER AND DIAMETER OF PEANER BOLT.			



5. OTHERS

No 106

**NIGATA**

CLASS No.	20540
SUB No.	00735A (1/5)

MODEL		WORK No.	
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**中間軸軸受据付要領書**  
**グリースタイプ軸受**

**INSTALLATION MANUAL FOR**  
**INTERMEDIATE SHAFT BEARING**  
**OF GREASE TYPE**

<b>A</b>	△部変更する。ベアリング封入要領変更する。			久保田	2008/04/16
MARK	REVISION	APPROVED	PASSED	DRAWN	DATE

**Niigata Power Systems Co., Ltd.**

ENGINEERING & TECHNOLOGY CENTER

APPROVED	<b>S.Ehata</b>
PASSED	<b>S.Ehata</b>
CHECKED	<b>T.Motoda</b>
DRAWN	<b>Y.Kubota</b>
DATE	<b>May./28/2007</b>



	<b>中間軸軸受据付要領</b> INSTALLATION MANUAL FOR INTERMEDIATE SHAFT BEARING	CLASS No	2 0 5 4 0
		SUB No.	0 0 7 3 5 A (3/5)

## 2. メンテナンス

### MAINTENANCE

#### 2-1 グリース交換時期

Grease exchange time

- ① グリースの取替えは運転 2 0 0 0 h を目安に実施のこと。

Exchange the grease by each 2000hr.

#### 2-2 グリース交換

Grease exchange

- ① グリースの交換は軸受ブロックの上部本体を取り外し、古いグリースを取り除く。

Remove the upper body of the bearing block, and remove the old grease .

- ② 古いグリースは針金等にウエスを巻き、ブロック溝に沿って押し出す等して取り除くこと。

Use the wire which is rolled by waste and push out along the block ditch at removing the old grease.

#### 2-3 グリース封入

Grease injection

- ① 封入するグリースはちょう度番号 2 号を使用すること。

Use the grease type 「JIS K2220 No2」 .

- ② 軸受ブロックへの封入

Injection into the bearing block

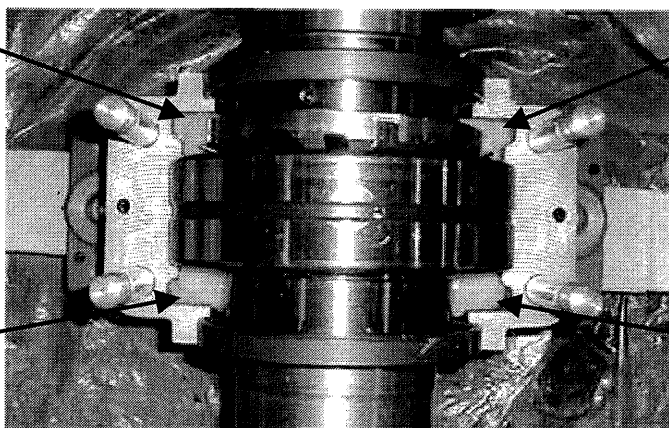
- ・ 図. 2 に示すグリース注入箇所へグリースガンを使用してグリースを注入する。

Inject the grease used by the grease gun into the points shown in Fig 2.

- ・ グリースの封入量は表. 1 に示す。

Amount of grease is shown in table 1.

グリース注入(1 / 4 [A] g)  
grease injection part



グリース注入(1 / 4 [A] g)  
grease injection part

グリース注入(1 / 4 [A] g)  
grease injection part

グリース注入(1 / 4 [A] g)  
grease injection part

図.2 グリース封入

Fig. 2 Grease injection

	<b>中間軸軸受据付要領</b> INSTALLATION MANUAL FOR INTERMEDIATE SHAFT BEARING	CLASS No	2 0 5 4 0
		SUB No.	0 0 7 3 5 A (4/5)

③ ベアリングへの封入  
Injection into the bearing

△

- ・ベアリングへの封入は、ベアリング外輪のグリース穴より注入する。(図.3 参照)  
The injection into the bearing from the grease hole of the bearing outer ring. (Shown in fig.3)
- ・注入する際は、ベアリング内部全体にグリースが行渡るように、必ずターニングをしながら注入する事。  
When injecting it, it injects it while doing the turning without fail so that grease may spread in all internal a bearing.
- ・グリースの封入量は表.1 に示す。  
Amount of grease is shown in table 1.

グリース注入 [B] g  
Injection Grease

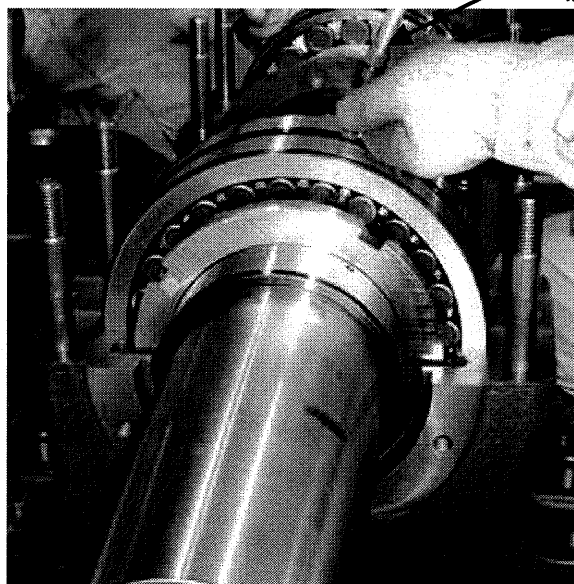


図.3 グリース封入  
Fig. 3 Grease injection

		スラスト軸受 THRUST BEARING	ラジアル軸受 RADIAL BEARING
φ 1 3 0 軸受 Shaft diameter 130 bearing	[A]	約 5 0 0 g Approx 5 0 0 g	約 5 0 0 g Approx 5 0 0 g
	[B]	約 1 0 0 g Approx 1 0 0 g	約 1 0 0 g Approx 1 0 0 g
φ 1 4 0 軸受 Shaft diameter 140 bearing	[A]	約 5 0 0 g Approx 5 0 0 g	約 5 0 0 g Approx 5 0 0 g
	[B]	約 1 8 0 g Approx 1 8 0 g	約 1 2 0 g Approx 1 2 0 g

表.1 グリース封入量  
Table. 1 Amount of grease

- [A] : 軸受ブロック  
[A] : Bearing block  
[B] : ベアリング  
[B] : Bearing

	<b>中間軸軸受据付要領</b> INSTALLATION MANUAL FOR INTERMEDIATE SHAFT BEARING	CLASS No	2 0 5 4 0
		SUB No.	0 0 7 3 5 A (5/5)

### 3. 注意

Attention

#### 3-1 据付上の注意

Attention for Installed work

- ① 軸受にはグリースを封入して納入します。  
 艀装時にはグリース注入しないこと。温度上昇の原因になります。  
 Injected the grease into the bearing and supplied.  
 Do not inject the grease in the shipyard. It causes the rise in heat.
- ② グリースタイプ軸受は運転開始直後、軸受温度が上がる事がありますが、  
 ベアリング内のグリースが馴染むと軸受温度も下がってきます。  
 The grease type bearing rises in temperature for immediately after beginning of driving,  
 but, It falls in temperature when grease in the bearing match.

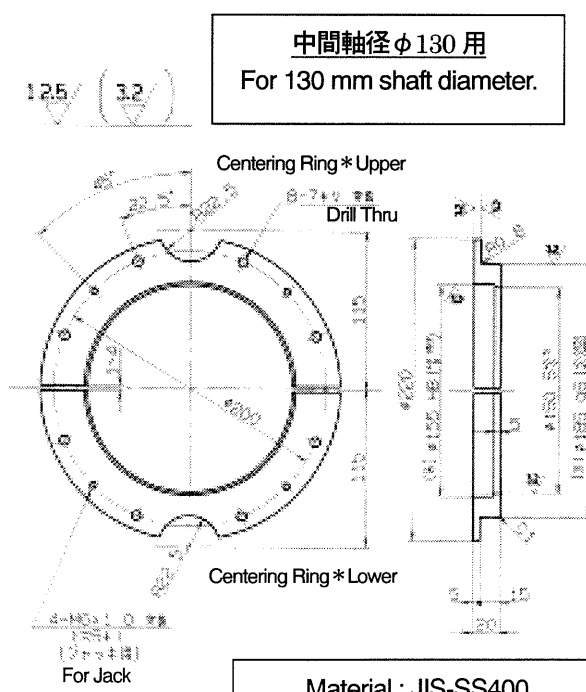
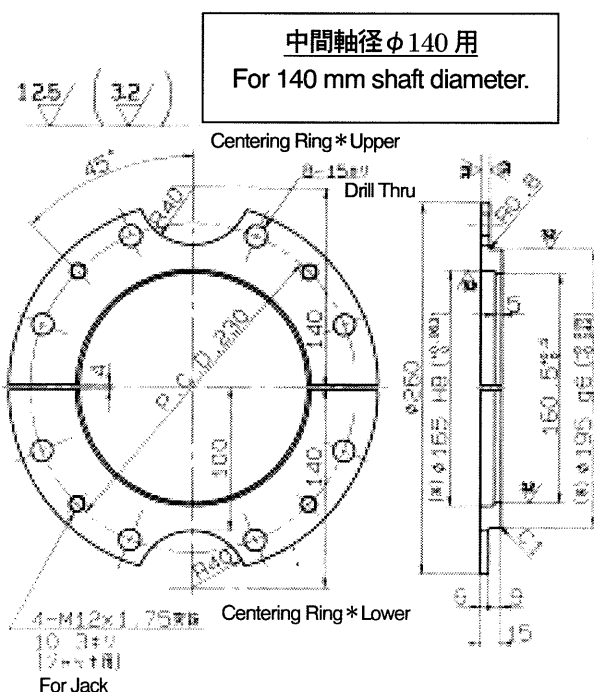
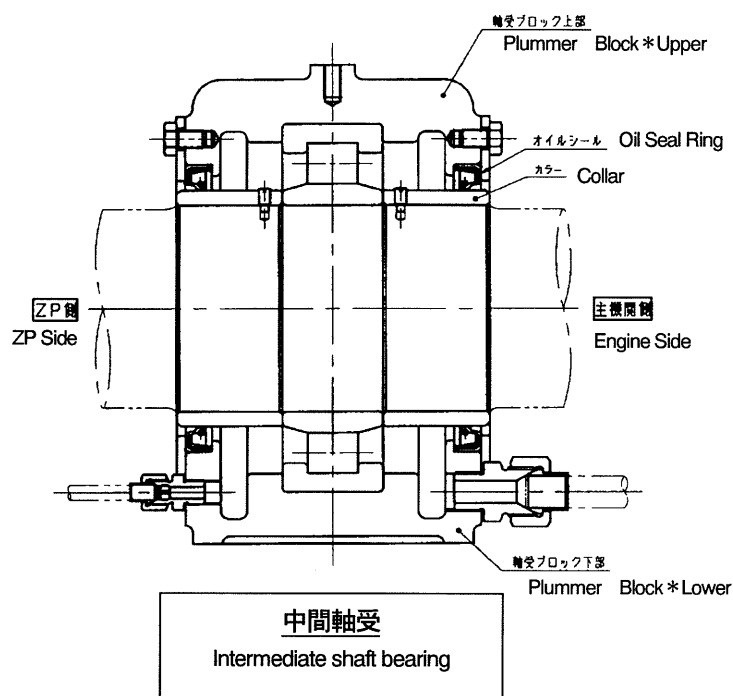


		CLASS No.		2 0 5 4 0	
		SUB No.		0 0 6 7 7 A (1 / 9)	
型式 MODEL	Intermediate shaft diameter φ 140 or φ 130		図番 DRAWING No.		
<p><b><u>中間軸軸受芯出しリング取付要領書</u></b></p> <p><i>Fitting procedure of the centering ring for the intermediate shaft bearing</i></p>					
A	REVISION A		久保田	園田	高橋
MARK	REVISION		DAWN	REVI	APPR
新 潟 原 動 機 株 式 会 社 NIIGATA POWER SYSTEMS CO., LTD.			APPROVED		REVIEWED
			高 橋		高 橋
			DRAWN		久 保 田
			高 橋		久 保 田
配 付 先	客 先	メ ー カ ー	営 業	N D S	原 調 達 部
		太 田 工 場		合 計	
		生 管	資 材	機 械	組 立
		品 管	技 サ	図 室	N M K
				控	
				計	
				DATE	
				2005.10.19	
				TOTAL 9 PAGES WITH COVER	

CLASS No.	2 0 5 4 0
SUB No.	0 0 6 7 7 A (2 / 9)

# 1. 器具名称

Name



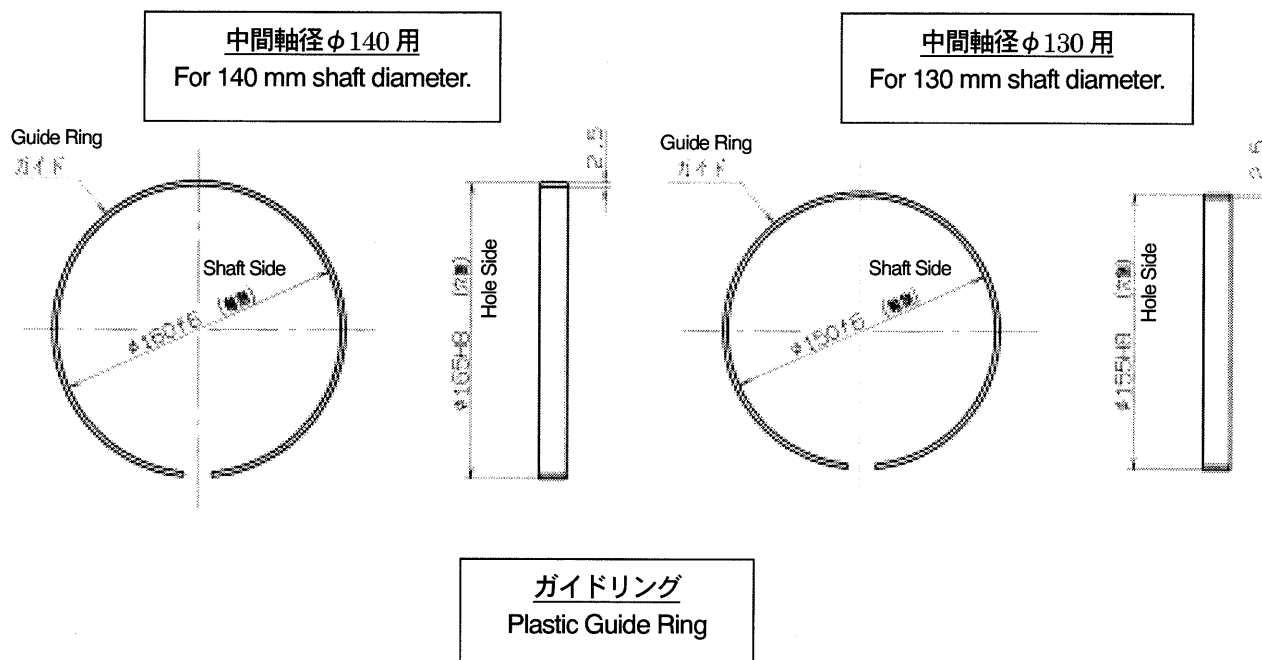
Material : JIS-SS400

芯出しリング  
Centering Ring

※芯出しリングは分割型とし上図に示す詳細にて造船所で作製する事。

The centering ring are split type and provided by shipyard in accordance with details as shown in upper fig.

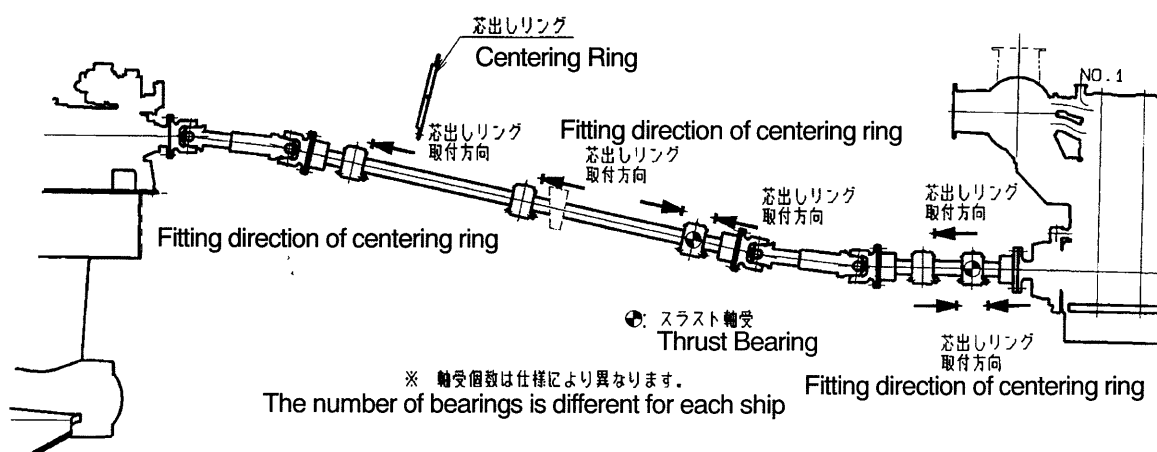
CLASS No.	2 0 5 4 0
SUB No.	0 0 6 7 7 A (3 / 9)



※ガイドは弊社より支給する。  
Guide ring is NIIGATA supply.

芯出し治具図面番号 drawing no. of Centering tool

	図面番号 Drawing No.	備考 Remarks
中間軸径 Shaft Diameter	φ 1 4 0      φ 1 3 0	
芯出しリング Centering Ring	9 9 5 6 2 0 5 8 2      9 9 5 6 2 0 5 9 0	
ガイドリング Plastic Guide Ring	9 7 7 5 9 3 1 7 0      9 7 7 5 9 3 8 4 0	未使用品を使用のこと。 Use new one every time



**芯出しリング取付位置**  
Position of fixing the centering rings

CLASS No.	2 0 5 4 0
SUB No.	0 0 6 7 7 A (4 / 9)

## 2. 芯出しリング取付上の注意

### Notice

- ① 芯出しリングの取付は中間軸を船体に積み込む前に行うこと。  
Before the intermediate shafts carry inboard, all bearings should be fixed by the centering rings.
- ② 芯出しリング取付時は艀装時のゴミや塵が入らない様、注意し取付ること。  
When installing the centering ring, be careful to avoid entering any foreign materials and dust.
- ③ スラスト軸受には両面から芯出しリングを取り付け、ラジアル軸受けには片面のみ芯出しリングを取り付けて芯出しを行うこと。  
Fix the centering ring to both sides of the thrust bearing block.  
And for the radial bearing block the centering ring should be fixed at one side only.
- ④ 最終的に浮き芯状態にて軸芯確認を行うこと。  
The final confirmation of alignment and centering must be carried out after launching.
- ⑤ 軸芯の確認結果は添付記録用紙へ必ず記録を残すこと。  
**The centering result confirmation must make a mark to an attached record table.**

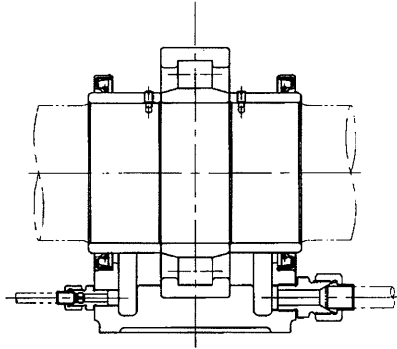
CLASS No.	2 0 5 4 0
SUB No.	0 0 6 7 7 A (5 / 9)

### 3. 取付要領

#### Fixing procedure

- ① 軸受ブロック上部を取り外す。(軸受ブロック上部を完全に取り外さずに軸受ブロック上部のジャッキ穴を使用してブロック上部をジャッキアップし5mm程度浮き上がらせた状態でも取付可能。オイルシールが取り外せる状態であれば良い。

Remove the oil seals, lift up "Bearing Block \* Upper" about 5 mm by using jack screw hole or remove.



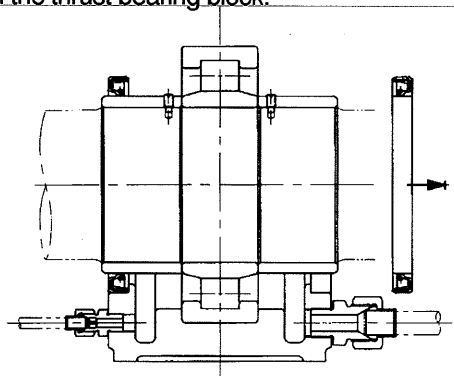
- ② オイルシールを取り外す。

※取り外したオイルシールは軸に抱かせたまま布やビニールなどで保護し、艀装時のゴミや塵が入らない様にする事。また、ラジアル軸受はオモテ側面、スラスト軸受は両面のオイルシールを取り外すこと。  
(2 / 6 頁「芯出しリング取付」を参照。)

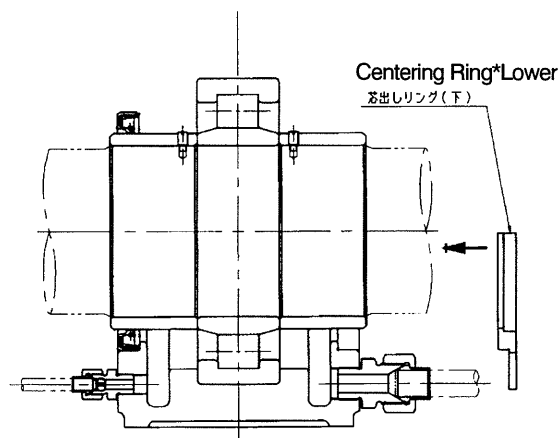
Remove the oil seals

The oil seal rings should be remained on the shaft and covered with the cloth or vinyl to keep clean.

Remove only bow side seal of the radial bearing block,  
and remove both side oil seals of the thrust bearing block.



- ③ 芯出しリング (下) を軸受ブロック下部のオイルシール取付箇所へ嵌め込む。(ボルトは仮留め。)  
"Centering Ring \* Lower" should be inserted to the oil seal installation part of "Bearing Block \* Lower".



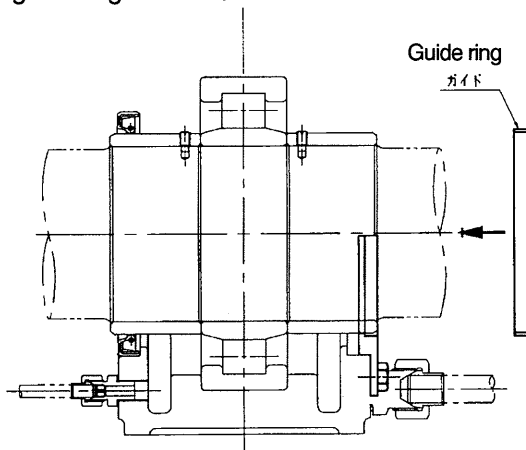
CLASS No.	2 0 5 4 0
SUB No.	0 0 6 7 7 A (6 / 9)

- ④ ガイドを軸（カラー）に巻き、芯出しリング内側へ差し込む。  
 ※本ガイドは消耗品です。ガイドが無い場合は弊社へ御注文下さい。

Roll up the plastic guide around the shaft (collar),  
 and slide it to the position of the "Centering Ring \* Lower".

Please order them if no stock.

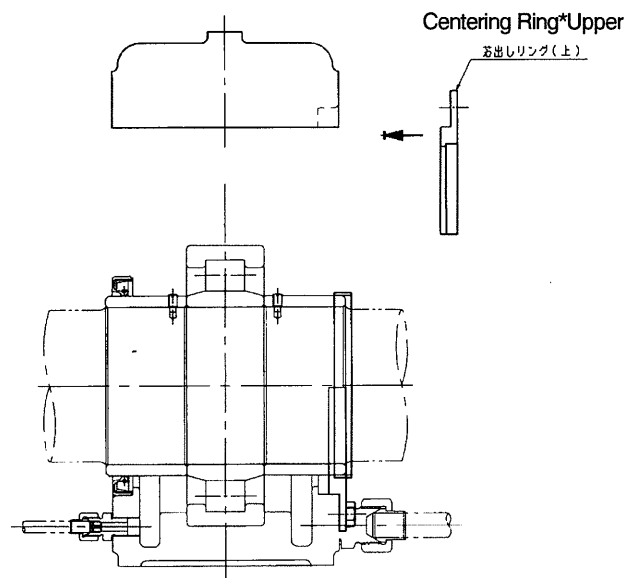
- ・軸径φ 1 4 0用 Guide ring Drawing No. for φ140 : 9 7 7 5 9 3 1 7 0 :
- ・軸径φ 1 3 0用 Guide ring Drawing No. for φ130 : 9 7 7 5 9 3 8 4 0 :



- ⑤ 軸受ブロック上部に芯出しリング（上）を嵌め込む。（ボルトは仮留め。）

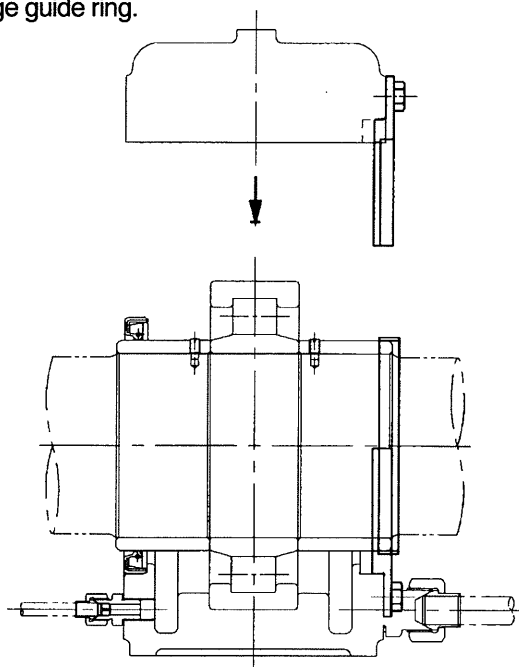
"Centering Ring \* Upper" shall be inserted to the oil seal  
 installation part of the "Bearing Block \* Upper".

The bolts should be a temporary tightening.

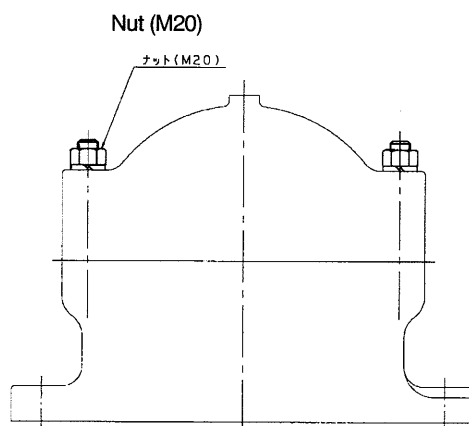


CLASS No.	2 0 5 4 0
SUB No.	0 0 6 7 7 A (7 / 9)

- ⑥ ⑤で芯出しリングを組み込んだ軸受ブロック上部を閉める。(この時ガイドの嵌め込みに注意する。)  
 Put "Plummer Block\*Upper" with centering Ring on "Plummer Block\*Lower".  
 Take care not to damage guide ring.



- ⑦ 軸受ブロックのナット (M20、締付トルク 176 N-m) を締める。  
 Tighten the nuts.  
 (Size ; M20 Tightening torque ;176 N-m)



- ⑧ 芯出しリング (上) (下) のボルトを本締めする。  
 Tighten the bolts at "Centering Ring \*Upper" and "Centering Ring \*Lower" by the tightening torque.

- ⑨ 浸水まで本状態のままとし、艀装時のゴミや塵に注意する。  
 This state is kept until the ship floats.  
 This time be careful to avoid entering any foreign materials and dust.

CLASS No.	2 0 5 4 0
SUB No.	0 0 6 7 7 A (8 / 9)

#### 4. 軸芯確認

##### Centering Confirmation

浸水後、軸芯の計測を行い許容値内に調整する事。

また、計測結果を添付計測用紙へ記録しておく事。

Angular alignment is adjusted with Radial alignment to a permissible value or less after the ship floats.

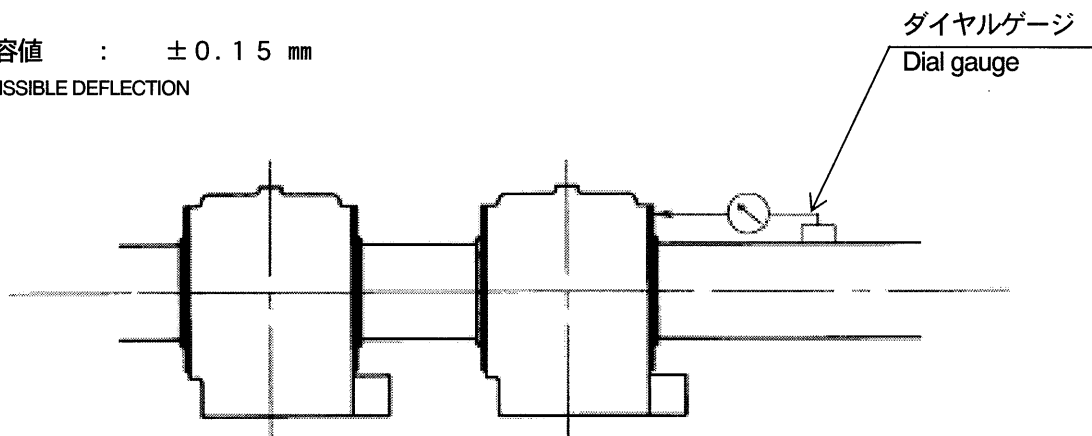
And the centering result confirmation must make a mark to an attached record table.

##### ① 軸受面振れ計測

##### Angular alignment

許容値 :  $\pm 0.15 \text{ mm}$

PERMISSIBLE DEFLECTION

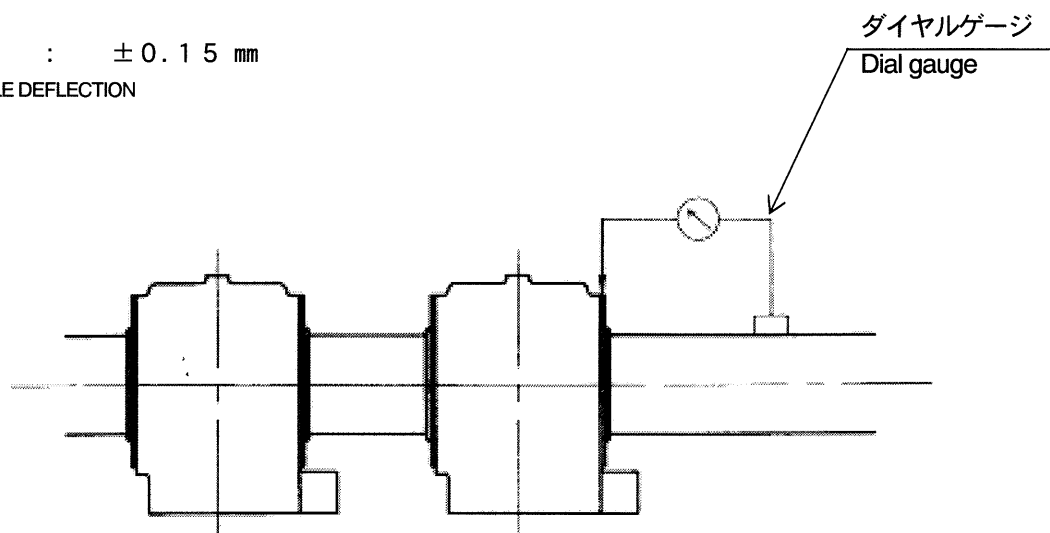


##### ② 軸受外周振れ計測

##### Radial alignment

許容値 :  $\pm 0.15 \text{ mm}$

PERMISSIBLE DEFLECTION





CLASS No.	2 0 5 4 0
SUB No.	0 0 6 7 7 A (9 / 9)

#### 4. 主機関運転前に

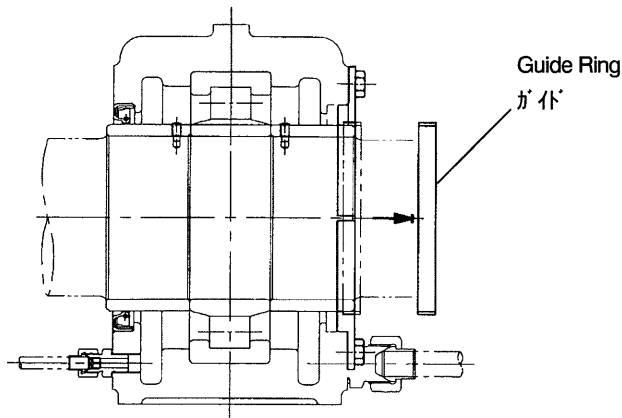
Before starting main engine

- ① ガイドを取り除く。(ドライバーなどで引き抜く。)

※ガイドが抜きづらい時は⑦で締めた軸受ブロック上部のナットを緩める。

Remove the "Plastic guide ring" by using screw driver or other tools.

If it is hard to pull out "Plastic Guide Ring", loosen the nuts of "Bearing Block \* Upper" tightened by step-⑦.



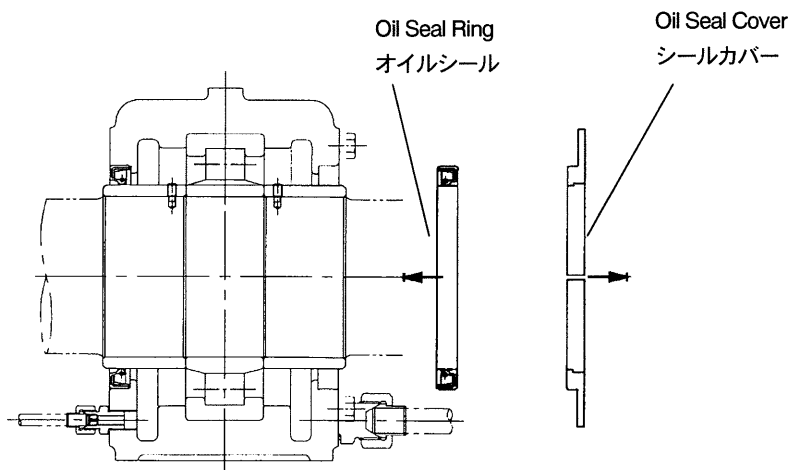
- ② 芯出しリングを取り外しオイルシールを嵌め込む。

※オイルシールを嵌め込む時はリップがしっかりとシールするように嵌め込むこと。

Remove the centering rings and insert the seal rings correctly with care of contact state on the seal lip.

- ③ オイルシールカバーを取付ける。

The oil seal covers shall be installed correctly and tighten the bolts surely.





CLASS No.	20540
SUB No.	00782-1/4

MODEL	BC and BE type	WORK No.		
<h1>GEISLINGER</h1> <h2>INSTALLATION MANUAL</h2>				
<p><b>Niigata Power Systems Co., Ltd.</b></p> <p>ENGINEERING &amp; TECHNOLOGY CENTER</p>			APPROVED	S. Takahashi
			CHECKED	M. Kawakita
			PREPARED	T.Tokitou
			DATE	May 1st. 2008

## Geislinger coupling installation

### 1. O-ring

1-1. Apply grease to the grooves on the face of flange. And then O-ring should be fitted into the grooves.

Note: O-ring is in vinyl pack and attached to engine.

### 2. Supporting tool

2-1. Which is provided to protect inside of coupling during transportation. This tool should be removed before coupling Geislinger coupling with clutch or horizontal shaft. And then adjustment of distance between input and output flange.

Note: This supporting tool should be stored and refitted when Geislinger coupling is moved.

### 3. Geislinger coupling is coupled with engine

3-1. And then make alignment by using the jack bolt set of main engine. And also, in parallel with marking alignment. Check and measure the crankshaft deflection of main engine No.6(8) cylinder.

Note: Measuring methods and tolerance for crankshaft deflection is referred to "Instruction manual for main engine".

3-2. Tolerances of alignment for Geislinger coupling are according to Fig.1.

Note: Above tolerances are for BE and BC type.

### 4. Geislinger coupling is coupled with clutch or horizontal shaft

4-1. Remove the supporting tool. And then adjustment of distance between input and output flange.

4-2. Tolerances of alignment for Geislinger coupling are according to Fig.2

**4-3. Check the clearance between all surroundings of inner-star and plate.  
The clearance is according to Fig.3**

Note: If there is not clearance between inner-star and plate, install Geislinger coupling from the beginning again.

### 5. Crankshaft deflection of Main engine

5-1. After finishing all alignment of shaft line up to Geislinger coupling. Crankshaft deflection of main engine all cylinders should be measured and confirmed to be within allowable tolerance.

Note: Measuring methods and tolerance for crankshaft deflection is referred to "Instruction manual for main engine".

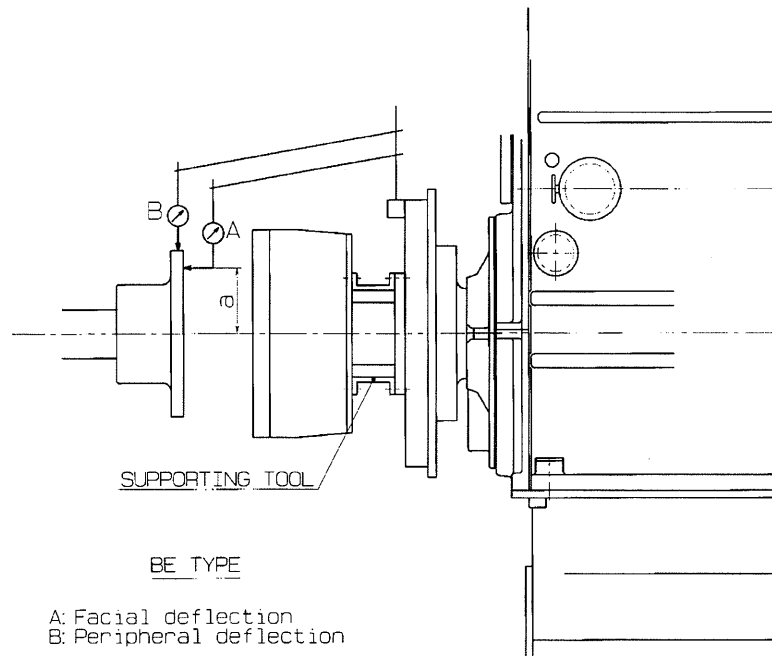
Geislinger coupling installation

Fig.1

A: within ' $a$ ' x 0.0007 (mm)

B: Tolerance of center misalignment is twice as much as the value of Table 1.

Note) a: Distance from shaft center to measurement point

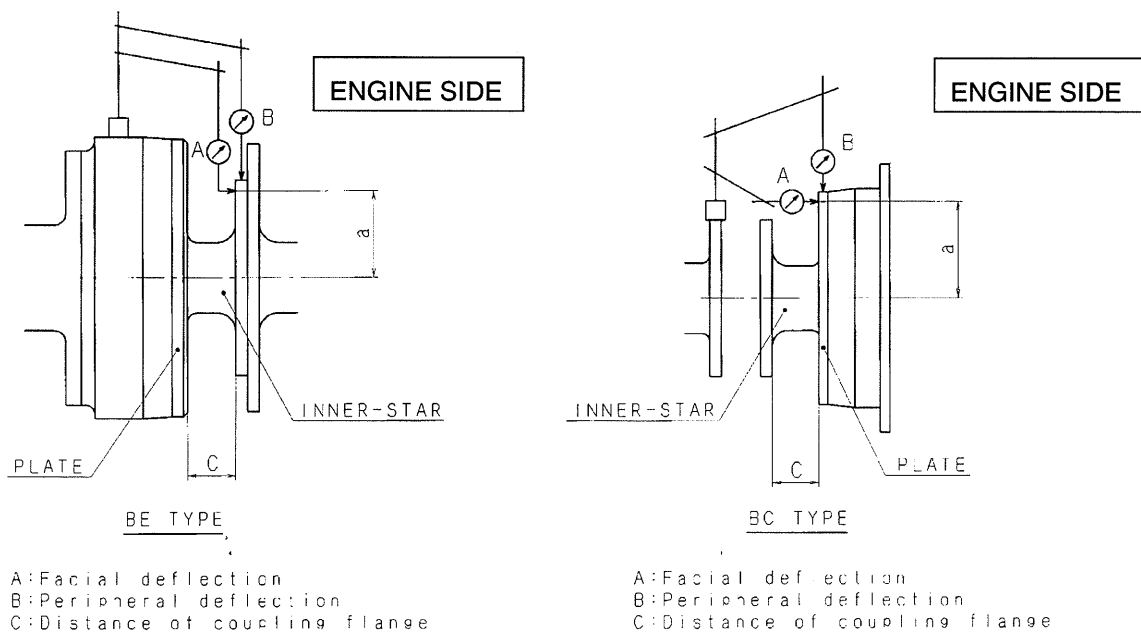


Fig.2

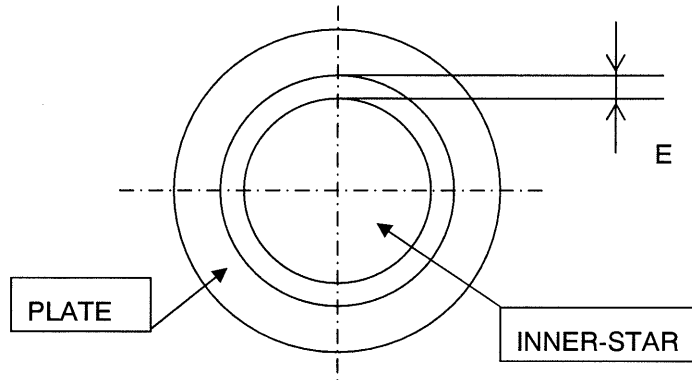
A: within ' $a$ ' x 0.0007 (mm)

B: Tolerance of center misalignment is twice as much as the value of Table 1.

C: refer to Table 1

Note) a: Distance from shaft center to measurement point

C dimension is reference. Actual distance from input flange to output flange is according to General view of main engine in DRAWING &amp; DOCUMENTS.

Geislinger coupling installation

E: Clearance between Inner-Star and Plate

Fig.3

E: within 'e' x 0.8 to 'e' x 1.2 (mm)

e: Clearance mean according to Table 1

Table 1

(Unit : mm)

No.	Model	Drawing No.	B	C	e
1	BC45c3	18020049F-54F	$\pm 0.12$	$133 \pm 0.5$	0.43
2	BC45c312 RO	18020305A	$\pm 0.12$	$125 \pm 0.5$	0.43
3	BE45c3	18020306A	$\pm 0.12$	$185 \pm 0.5$	0.43
4	BC48/10/85 RO	F8001069A	$\pm 0.12$	$109 \pm 0.5$	0.34
5	BE48/10/85 RO	F8001038A-43F	$\pm 0.12$	$197 \pm 0.5$	0.34
6	BC56c312S	18021107D-12D	$\pm 0.15$	$119 \pm 0.5$	0.54
7	BC56c312RO	18021341A-342A	$\pm 0.15$	$105 \pm 0.5$	0.54
8	BC56/12.5/85	F8002034A-39A	$\pm 0.15$	$107 \pm 0.5$	0.53
9	BC56/12.5/85 RO	F8002086A-89A	$\pm 0.15$	$96 \pm 0.5$	0.53
10	BC63/15/140U	F8003130A	$\pm 0.17$	$81 \pm 0.5$	0.49
11	BE63/15/140U	F8003129A	$\pm 0.17$	$83 \pm 0.5$	0.49
12	BE63/15/85	F8003128A	$\pm 0.17$	$145 \pm 0.5$	0.61
13	BE63/15/85 RO	F8003124A	$\pm 0.17$	$145 \pm 0.5$	0.61
14	BE72/15/140	F8004089A,91A	$\pm 0.2$	$125 \pm 0.5$	0.57