DET NORSKE VERITAS

ENGINE INTERNATIONAL AIR POLLUTION PREVENTION CERTIFICATE

This Certificate shall be supplemented by
a Record of Construction, a Technical File and Means of Verification

Certificate no.:
EIAPP-1610-1-A
Date of issue:
2014-01-08

Issued under the provisions of the Protocol of 1997, as amended by Resolution MEPC.176(58) in 2008, to amend the International Convention for the Prevention of Pollution from Ships, 1973, as modified of the Protocol of 1978 related thereto (hereinafter referred to as "the Convention") under the authority of the Government of

LA REPÚBLICA DE PANAMÁ/ THE REPUBLIC OF PANAMA

by **Det Norske Veritas**

Particulars of engine

Engine manufacturer:	**STX Engine Co., Ltd.**
Model number:	**STX-MAN 14V32/40**
Serial number:	**SB14V32-12687**
Test cycles(s):	**E2,E3**
Rated power [kW] and speed [rpm]:	**6300 kW @ 750 rpm**
Engine approval number:	**EIAPP-G-1610-0001**

THIS IS TO CERTIFY:

1. That the above mentioned marine diesel engine has been surveyed for pre-certification in accordance with the requirements of the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines 2008 made mandatory by Annex VI of the Convention; and

2. That the pre-certification survey shows that the engine, its components, adjustable features, and technical file, prior to the engine's installation and/or service onboard a ship, fully comply with the applicable regulation 13 of Annex VI of the Convention.

Remarks/Recommendations:

This Certificate is valid for the life of the engine subject to surveys in accordance with Regulation 5 of the ANNEX VI of the Convention, installed in ships under the authority of this Government.

Issued at **Høvik** on **2014-01-08** (date)

for **Det Norske Veritas AS**

Oddvar Deinboll
Head of Section

DET NORSKE VERITAS * 1864 *

SUPPLEMENT TO ENGINE INTERNATIONAL AIR POLLUTION PREVENTION CERTIFICATE (EIAPP CERTIFICATE)

RECORD OF CONSTRUCTION, TECHNICAL FILE AND MEANS OF VERIFICATION

Notes:

1 This Record and its attachments shall be permanently attached to the EIAPP Certificate. The EIAPP Certificate shall accompany the engine throughout its life and shall be available on board the ship at all times.

2 The Record shall be in English, French or Spanish. If an official language of the issuing country is also used, this shall prevail in case of a dispute or discrepancy.

3 Unless otherwise stated, regulations mentioned in this Record refer to regulations of Annex VI of the Convention and the requirements for an engine's technical file and means of verifications refer to mandatory requirements from the NO_X Technical Code 2008.

1. Particulars of the engine

.1 Name and address of manufacturer. **STX Engine Co., Ltd.**
80, Seongsan-dong, Changwon, Kyungsangnam-Do, Korea

.2 Place of engine build ..... **As above**

.3 Date of engine build ..... **August 2013**

.4 Place of pre-certification survey ..... **As above**

.5 Date of pre-certification survey **2013-08-22**

.6 Engine type and model number ..... **STX-MAN 14V32/40**

.7 Engine serial number **SB14V32-12687**

.8 If applicable, the engine is a parent engine [X] or a member engine [-] of the following engine family [-] or engine group [X]. **V32 45 75 E2 E3**

.9 Individual engine or engine family / engine group details:

.1 Approval reference **EIAPP-G-1610-0001**

.2 Rated power [kw] and rated speed [rpm] values or range ..... **6300 kW @ 750 rpm**

.3 Test cycle(s) **E2,E3**

.4 Parent engine(s) test fuel oil specification ..... **ISO 8217-F- DMC Grade**

.5 Applicable NOx emission limit [g/kwh], regulation **13.4** **9.6**

.6 Parent engine(s) emission value, cycle **E2,E3**, [g/kWh] ..... **8.4 / 9.1**

2 Particulars of the technical file

The Technical File, as required by chapter 2 of the NOx Technical Code 2008, is an essential part of the EIAPP Certificate and must always accompany an engine throughout its life and always be available on board a ship.

.1 Technical file identification/approval number **EIAPP-G-1610-0001**

.2 Technical file approval date **2014-01-08**

3. Specifications for the onboard NO_X verification procedure

The specifications for the onboard NOx verification procedures, as required by Ch. 6 of the NOx Technical Code 2008, are an essential part of the EIAPP Certificate and must always accompany an engine throughout its life and always be available on board a ship.

.1 Engine parameter check method:

.1 Identification/approval number **EIAPP-G-1610-0001**

.2 Approval date **2014-01-08**

.2 Direct measurement and monitoring method:

.1 Identification/approval number ..... **Not applicable**

.2 Approval date ..... **Not applicable**

Alternatively the simplified measurement method in accordance with 6.3 of the NO_X Technical Code 2008 may be utilized.

THIS IS TO CERTIFY that this Record is correct in all respects:

Issued at **Høvik** on **2014-01-08** (date)

for **Det Norske Veritas AS**

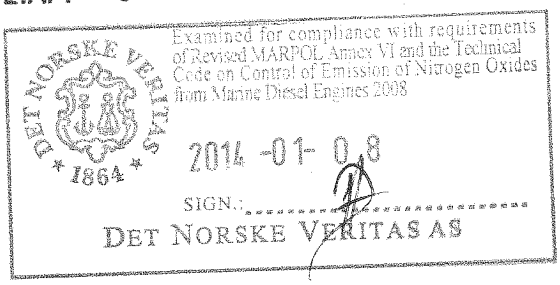
DET NORSKE VERITAS * 1864 *

Oddvar Deinboll
Head of Section

Technical file
for Parent engine

Engine Group : V32 45 75 E2 E3

EIAPP- G - 1 6 1 0 - 0 0 0 1



0	FINAL	2011-08-29
NO	DESCRIPTION	DATE

SHIP BUILDING	JIANGDONG	OWNER	RONGTAI
HULL NO.	JD10000 CBM-1	RATED POWER	450 kW/cyl.
ENGINE TYPE	V32/40	RATED SPEED	750 rpm
ENGINE SER. NO.	SB14V32-12687	NO. OF CYLINDER	12,14,16,18
TEST DATE	2013-08-19	Test cycle	E2, E3

stx Engine

Contents

1. Emission warning

1.1 General background

As general background information, the precursors to the formation of nitrogen oxides during the combustion process are nitrogen and oxygen. Together these compounds comprise 99% of the engine intake air. Oxygen will be consumed during the combustion process, with the amount of excess oxygen available being a function of the air / fuel ratio which the engine is operating under.

The nitrogen remains largely un-reacted in the combustion process, however a small percentage will be oxidized to form various oxides of nitrogen. the nitrogen oxides (NOx) which can be formed included NO and NO_2, while the amounts are primarily a function of flame or combustion temperature and, if present, the amount of organic nitrogen available from the fuel. It is also a function of the time the nitrogen and excess oxygen are exposed to the high temperatures associated with the diesel engine's combustion process.

In other words, the higher the combustion temperature (e.g., high peak pressure, high compression ratio, high rate of fuel delivery, etc.) the greater the amount of NOx formation.

1.2 Oxides of nitrogen (NOx)

The term NOx (nitrogen oxides) is general term that covers both NO, N_2O and NO_2 in the context of exhaust emissions. NOx has been identified as particularly harmful, as it causes "acid rain", is toxic, and can contribute to atmospheric smog under certain conditions. the oxides of nitrogen are believed to cause emphysema and contribute substantially to acid rain and smog formation.

NOx also increases the local ozone concentration, which has a detrimental effect on vegetation. Small quantities of laughing gas (N_2O) can also be present among other oxides of nitrogen N_2O destroys ozone in the stratosphere where it is needed for UV light filtration.

NOx has an adverse effect on the environment causing acidification, formation of ozone, nutrient enrichment and contributes to adverse health effects globally.

2. Components, settings and operating values of the engines that influence its NOx emissions

- Cylinder head
- Piston (Upper/Lower part)
- Sealing ring (Between cyl. head and top land ring)
- Connecting rod
- Fuel injection pump
- Fuel injection nozzle
- Fuel camshaft
- Turbocharger
  - Compressor wheel
  - Diffuser
  - Nozzle ring
  - Turbine rotor
- Air cooler
- Injection timing adjusted affecting NOx emission

3. Range of allowable adjustment or alternatives for the components of the engine

Injection timing check method :

For all members of this engine group, an external adjustment of fuel injection timing is allowed, as far as the mean value is less than as below value :

(Plunger lift @ TDC) **Ave. 10.50** mm

4. Engine group information

4.1 General

Engine manufacturer		STX Engine Co., Ltd.
Application	Constant speed main propulsion,	Propeller law operated main engine
Engine type		V32/40
No. of cylinder		12,14,16,18

Rated speed	750 rpm
Nominal rated power	450 kW/cyl.
Bore	320 mm
Stroke	400 mm
Compression ratio	15.2
Mean effective pressure at nominal rated power	22.4 bar
Combustion cycle	4 stroke cycle
Cooling medium	Water
Method of aspiration	Pressure charged
Cylinder configuration	V
Combustion chamber	Open chamber
Valve port configuration	Cylinder head
Cooling system specification	Intermediate cooler, two stage
Inlet valve closing angle	21.0 ABDC

4.2 Emission test result for parent engine

IMO NOx Test cycle		E2 E3
Test date		2013-08-19
IMO NOx specific / Limit	E2	8.36 / 9.60 g/kWh
	E3	9.10 / 9.60 g/kWh

4.3 Specified ambient conditions

Cooling water temp. engine inl	32℃ (Corresponding reference seewater 25℃)
Max. charge air temperature at rated power	55℃
Max. exhaust back pressure	240 mmH2O (at nominal rated power)
Fuel oil type to be used on-board	Distillate or HFO
Lubrication oil specification	SAE40

4.4 Auxiliaries

Electronic injection control	No
Variable injection timing	Yes
Exhaust gas re-circulation	No
Water injection/emulsion	No

Air injection	No
Exhaust after the treatment	No
Variable turbocharger geometry	No

5. Designation and restrictions for an engine which is member of an engine group

Members of the engine group should be engines with perfomance according to para. "4. Engine group information", equipped with according to Appendix. "Conformity of NOx Emission ID Nos." and adjusted according to para. "2. Range of allowable adjustment or alternatives for the components of the engine".

6. Specifications of spare parts / components

• See "Appendix. Conformity of NOx Emission ID Nos."

EIAPP- G - 1 6 1 0 - 0 0 0 1

DET NORSKE VERITAS * 1864 *

Examined for compliance with requirements of Revised MARPOL Annex VI and the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines 2008

2014 -01- 08

SIGN.: .....

DET NORSKE VERITAS AS

7. On-board NOx verification procedure

The specification for the on-board NOx verification procedures, as required by the NOx Technical Code 2008, is an essential part of the EIAPP Certificate and must always accompany an engine through its life and always be available on board the ship at all times.

These procedures are valid for the life of the engine subject to surveys in accordance with regulation of Annex VI of the Convention, installed in ships under the authority of this Government.

7.1 Verifiying the fuel injection timing

7.1.1 Purpose

Enable an on-board verification of the static injection timing.

7.1.2 Brief description

Examine the injection timing within the scope of the IMO certification.

The work includes : determining the plunger lift.

7.1.3 Operating sequence

1) Remove camshaft casing cover.

2) Check the mobility of the ledge and the prism.

3) Position the support on the two bolts of the camshaft covering, slip on the distance sleeves and fasten to the cylinder crankcase by means of hexagon nuts.

Note : During attaching, pay attention to the correct fitting position of the prism.

4) Check the fitting position and/or the position of the prism in relation to the injection pump drive.

5) Insert the dial gauge into the support and clamp it using the hexagon socket bolt.

6) Turn the engine until the cam base circle is reached.

7) Check the VIT position (see the appendix. Adjustment data sheet)

8) Set the dial gauge to "Zero".

9) Turn the engine until the TDC mark(ignition DC) for the actual cylinder is reached. Read the dial gauge and note down the gauge value.

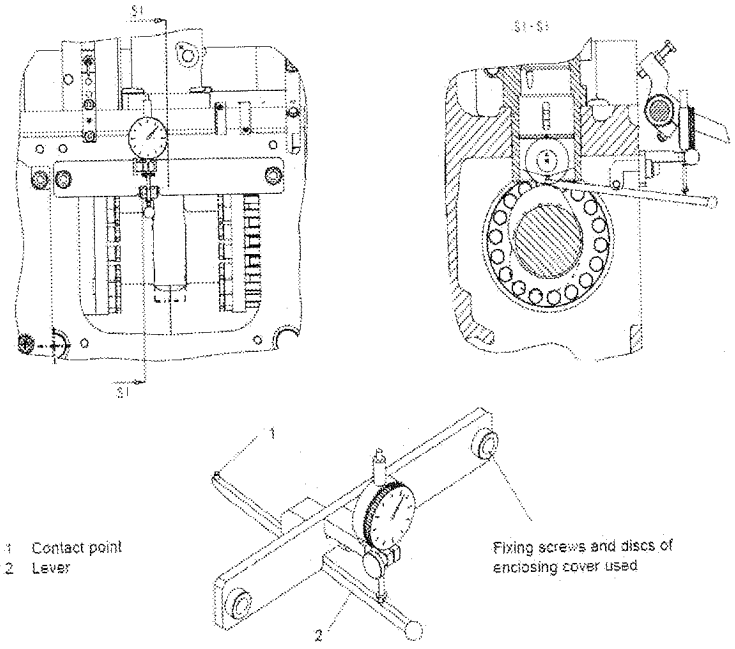
10) Remove the complete tool.

11) Determine the values for the other cylinder in the same way.

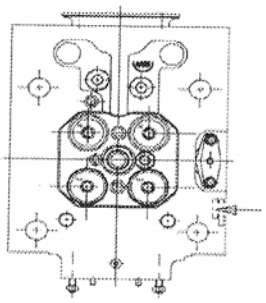
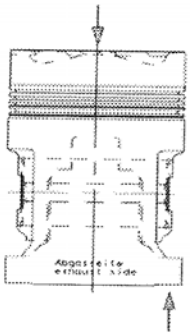
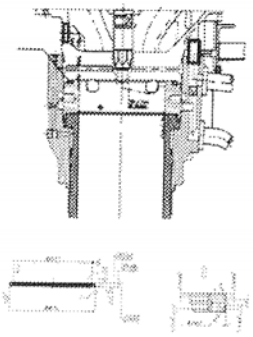
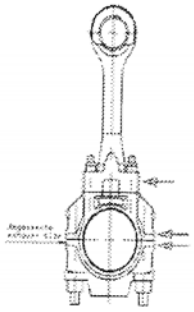
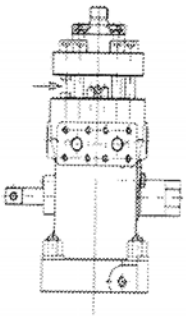
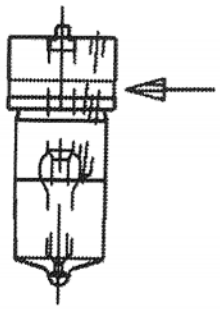
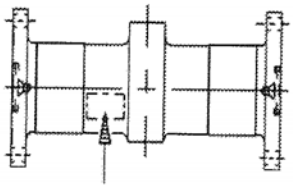
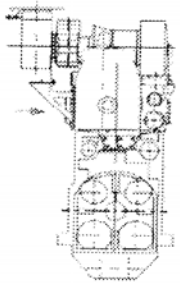
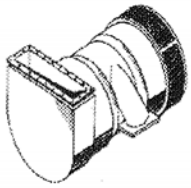
12) Record the values and average the measured plunger lift values of each cylinder.

13) Compare the value determine with the value of the IMO certification.

14) Replace all camshaft casing covers.



7.2 Verifiying the IMO ID on NOx compenents

Cylinder Head  IMO-0845	**Piston**  Upper : IMO-2028 or 2134 Lower : IMO-3814 or 3299	**Sealing ring**  10 ± 0.05mm
Con-Rod  IMO-0721	**Fuel Pump**  IMO-1228	**Fuel Nozzle**  IMO-1611
Fuel Camshaft  IMO-8046	**Air Cooler**  12V, 14V IMO-0720 16V, 18V IMO-0721	**Turbocharger**  12V NR29/S175 14V NR29/S172 16V NR34/S*** 18V NR34/S***

* Compressor wheel, Nozzling, Turbine, Diffusor : See the appendix. technical file for turbochager

7.3. Checking the VIT position

Read the scale of VIT equipment as Fig.3 VIT position scale.

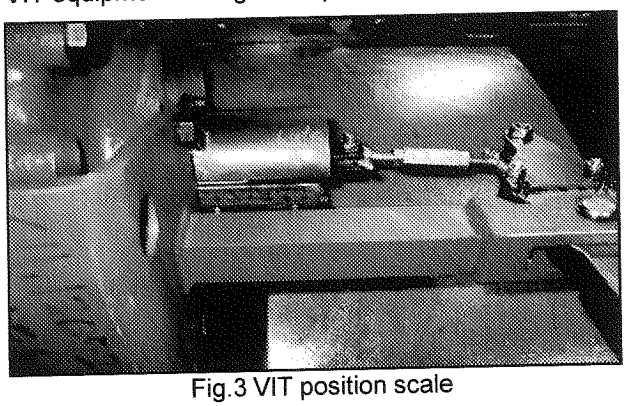


Fig.3 VIT position scale

We recommend to adjust for load > 80% the VIT to zero position.

Reason: Zero position is the safe position in case of "emergency operation " i.e. in case that VIT-control is disturbed.

- In consequence:

0~45% Load	VIT scale -10
45~80% Load	VIT scale +25
Over 80% Load	VIT scale 0

That is valid for CW-rotating engine.

In case of CCW rotation the scale for VIT position will change from + to – and vice versa.

7.4 Record book of engine parameters

This Record book of engine parameters is the document for recording all parameter changes, including components and engine settings, which may influence NOx emission of the engine.

If any adjustments or modification are made to the engine after its pre-certification, a full record of such adjustments or modification shall be recorded in this engine's Record book of engine parameters.

Adjustments carried out	Remarks	Date	Sign

stx Engine

SHOP TRIAL RECORD OF DIESEL ENGINE

ORDER : -

OWNER : RONGTAI

SHIPYARD : JIANGDONG

HULL No. : JD10000 CBM-1 SHIP NAME : -

MODEL : 14V32/40 ENGINE No.: SB14V32-12687

DATE : 2013-08-19

IMO NOx TEST

WITNESSED BY -	APPROVED BY - (STX Eng)
WITNESSED BY - (OWNER)	CHECKED BY - (STX Eng)
WITNESSED BY - (SHIPYARD)	CHECKED BY (STX Eng) D.H.Kim
WITNESSED BY - (CLASS)	DRAWN BY - (STX Eng)

STX ENGINE CO., LTD.

1. Specification of test engine

ENGINE NO. SB14V32-12687 DATE : 2013-08-19

MAIN DATA FOR DIESEL ENGINE	ENGINE MODEL	14V32/40
	NO. OF CYLINDER	14 ea
	CYCLE	4-STROKE
	DIAMETER OF CYLINDER	320 mm
	STROKE OF PISTON	400 mm
	RATED OUTPUT	6300 kW
	RATED SPEED	750 rpm
	MAX.FIRING PRESSURE (IN COMBUSTION CHAMBER / TEST	190 / 197 bar
	ROTATION DIRECTION	C.W. VIEW FROM FLYWHEEL
DYNAMOMETER	MAKER	ZOLLINER-KIEL
	TYPE	12N2N80F
	CAPACITY	10000 kW
	MAXIMUM SPEED	1500 RPM
GOVERNOR	MAKER / TYPE	HEINZMANN
	SERIAL NO	12 05 000102-180
	ACTUATOR SERIAL NO	12 03 035983-180
TURBO CHARGER	MAKER	STX Metal - MAN
	TYPE	NR29/S172
	SERIAL NO	A : SJQ 0083 B: SJQ 0084
ACCESSORIES	AIR COOLER SERIAL NO.	A: 20013649-40-001 B: 20007666-50-04
	L.O COOLER SERIAL NO.	N/A
	F.O PUMP SERIAL NO.	N/A
	L.O PUMP SERIAL NO.	5026832 P.10/1
	H.T F.W PUMP SERIAL NO.	JD10000CBM.1955
	L.T F.W PUMP SERIAL NO.	-
FUEL OIL (PRELMINARY)	NAME	ISO-F-DMA
	SPECIFIC GRAVITY	0.8296 (@15/4℃)
	VISCOSITY	3.20 (CST @ 40.0 ℃)
	L.C.V	10269 kcal/kg
LUB. OIL FOR ENGINE & T/C	NAME	DN MARINE SX 40
	SPECIFIC GRAVITY	0.8900 (@ 15/4 ℃)
	VISCOSITY	133.1 (CST @ 40℃)

2. ENGINE LOAD TEST SHEET (1)

ENGINE NO. : SB14V32-12687 BED NO.: 9(A1) DATE : 2013-08-19

LOAD			%	25%	50%	75%	25%	50%	75%	100%	REMARK
TIME OF RECORDING			min	20	20	20	20	20	20	20	
ENGINE SPEED			rpm	473	600	683	750	750	750	750	
DYNAMOMETER SPEED			rpm	-	-	-	-	-	-	-	
DYNAMOMETER LOAD			kNm	-	-	-	-	-	-	-	
ENGINE LOAD			kW	1575	3150	4725	1575	3150	4725	6300	
T/C SPEED	A-BANK (X1000)		rpm	11.3	21.4	25.8	13.4	21.4	26.4	29.1	
	B-BANK (X1000)		rpm	11.4	21.5	25.7	13.4	21.2	26.4	29.2	
GOVERNOR POSITION			POS.	45.0	50.0	70.0	37.0	53.0	68.0	80.0	
AMBIENT TEMPERATURE			℃	34.9	36.9	35.5	35.0	35.2	36.0	34.0	
ATMOSPHERE PRESSURE			mbar	1003	1004	1004	1004	1004	1004	1005	
FUEL OIL CONSUMPTION	MEASURING		kg	56.8	106.6	152.2	61.5	112.3	162.5	211.8	
	TIME		min/Sec	10'00''	10'00''	10'00''	10'00''	10'00''	10'00''	10'00''	
	CONSUMPTION		kg/h	340.8	639.6	913.2	369.0	673.8	975.0	1270.8	
	CONSUMPTION		g/kW/h	216.4	203.0	193.3	234.3	213.9	206.3	201.7	
	ISO,CONSUMPTION		g/kW/h	216.0	202.3	192.6	233.6	213.2	205.4	201.2	
COOLING WATER	H/T PRESSURE		bar	1.7	2.2	2.2	2.5	2.7	2.8	2.9	
	L/T PRESSURE		bar	1.9	1.9	1.9	1.9	1.9	1.9	1.9	
CHARGE AIR ENGINE INLET PRESS			bar	0.3/0.3	1.3/1.3	2.2/2.2	0.4/0.4	1.3/1.3	2.4/2.4	3.1/3.1	
L.O PRESS T/C INLET	FORE SIDE		bar	-	-	-	-	-	-	-	
	AFTER SIDE		bar	-	-	-	-	-	-	-	
NOZZLE COOLING WATER PRESS			bar	-	-	-	-	-	-	-	
FUEL OIL ENGINE INLET PRESS			bar	6.1	6.1	6.2	6.5	6.4	6.4	6.3	
LUB OIL PRESSURE	PUMP OUTLET		bar	-	-	-	-	-	-	-	
	ENGINE INLET		bar	4.1	4.7	4.7	4.7	4.7	4.7	4.6	
	T/C IN (A-BANK)		bar	1.2	1.7	1.9	1.4	1.7	1.9	1.9	
	T/C IN (B-BANK)		bar	1.2	1.7	1.9	1.4	1.7	1.9	1.9	
FUEL INJECTION PUMP RACK POSITION (A-BANK)		1	mm	18.5	24.5	31.0	14.0	22.0	29.0	36.0	
		2	mm	18.5	24.5	31.0	14.0	21.5	29.0	36.0	
		3	mm	18.5	24.5	31.0	14.0	21.5	29.0	36.0	
		4	mm	18.5	24.5	31.0	14.0	22.0	29.0	36.0	
		5	mm	18.5	24.5	31.0	14.0	22.0	29.0	36.0	
		6	mm	18.5	24.5	31.0	14.0	22.0	29.0	36.0	
		7	mm	18.5	24.5	31.0	14.0	21.5	29.0	36.0	
		8	mm	-	-	-	-	-	-	-	
		9	mm	-	-	-	-	-	-	-	
		Mean	mm	18.5	24.5	31.0	14.0	21.8	29.0	36.0	
FUEL INJECTION PUMP RACK POSITION (B-BANK)		1	mm	19.0	25.0	31.5	14.5	22.5	30.0	36.5	
		2	mm	19.0	25.0	31.5	14.5	22.5	30.0	36.5	
		3	mm	19.0	25.0	31.5	14.5	22.5	30.0	36.5	
		4	mm	19.0	25.0	31.5	14.5	22.5	30.0	36.5	
		5	mm	19.0	25.0	31.5	14.5	22.0	29.5	36.5	
		6	mm	19.0	25.0	31.5	14.5	22.5	30.0	36.5	
		7	mm	19.0	25.0	31.5	14.5	22.0	29.5	36.5	
		8	mm	-	-	-	-	-	-	-	
		9	mm	-	-	-	-	-	-	-	
		Mean	mm	19.0	25.0	31.5	14.5	22.4	29.9	36.5	

3. ENGINE LOAD TEST SHEET (2)

ENGINE NO. : SB14V32-12687 BED NO.: 9(A1) DATE : 2013-08-19

LOAD			%	25%	50%	75%	25%	50%	75%	100%	REMARK
TIME OF RECORDING			min	20	20	20	20	20	20	20	
MAXIMUM FIRING PRESSURE (AT INDICATOR COCK)	A-BANK	1	bar	98	118	146	86	106	144	195	
		2	bar	97	119	146	83	104	145	195	
		3	bar	99	120	147	87	108	145	196	
		4	bar	99	120	147	87	106	145	197	
		5	bar	99	120	146	89	108	143	194	
		6	bar	99	117	145	86	105	143	194	
		7	bar	100	122	147	90	110	144	194	
		8	bar		-	-	-	-	-	-	
		9	bar		-	-	-	-	-	-	
		Mean	bar	98.7	119.4	146.3	86.9	106.7	144.1	195.0	
	B-BANK	1	bar	102	121	149	89	109	147	198	
		2	bar	101	121	150	87	109	147	198	
		3	bar	101	120	147	88	108	146	196	
		4	bar	99	118	144	87	107	145	194	
		5	bar	101	121	148	90	108	146	194	
		6	bar	101	122	149	89	111	147	194	
		7	bar	103	123	147	89	111	146	194	
		8	bar		-	-	-	-	-	-	
		9	bar		-	-	-	-	-	-	
		Mean	bar	101.1	120.9	147.7	88.4	109.0	146.3	195.4	
EXHAUST GAS TEMPERATURE	CYLINDER OUTLET (A-BANK)	1	℃	369	382	361	354	357	380	413	
		2	℃	358	368	346	331	345	369	403	
		3	℃	364	374	341	325	342	359	386	
		4	℃	362	392	367	367	362	371	402	
		5	℃	364	367	339	353	343	352	385	
		6	℃	379	368	345	347	350	369	397	
		7	℃	369	357	338	336	339	357	387	
		8	℃		-	-	-	-	-	-	
		9	℃		-	-	-	-	-	-	
		Mean	℃	366.4	372.6	348.1	344.7	348.3	365.3	396.1	
	CYLINDER OUTLET (B-BANK)	1	℃	428	404	366	384	374	379	410	
		2	℃	409	394	374	382	368	386	417	
		3	℃	397	383	356	374	369	376	406	
		4	℃	398	398	374	374	369	392	422	
		5	℃	403	387	350	363	350	359	384	
		6	℃	393	389	354	343	346	369	394	
		7	℃	379	360	328	323	328	334	360	
		8	℃		-	-	-	-	-	-	
		9	℃		-	-	-	-	-	-	
		Mean	℃	401.0	387.9	357.4	363.3	357.7	370.7	399.0	
	T/C INLET	A	℃	418	438	480	396	443	465	500	
		B	℃	440	433	480	396	441	465	494	
	T/C OUTLET	A	℃	367	308	333	350	343	310	314	
		B	℃	410	337	335	349	340	313	311	
T/C INLET AIR TEMP		A	℃	36	37	37	37	37	35	34	
		B	℃	36	37	37	37	37	35	34	
T/C OUTLET BACK PRESSURE			mmAq	10	80	130	20	80	170	240	
CRANK CASE INSIDE PRESSURE			mmAq	8	9	12	11	11	12	12	

4. ENGINE LOAD TEST SHEET (3)

ENGINE NO. : SB14V32-12687 BED NO.: 9(A1) DATE : 2013-08-19

LOAD		%	25%	50%	75%	25%	50%	75%	100%	REMARK
TIME OF RECORDING		min	20	20	20	20	20	20	20	
LOW TEMP. COOLING WATER TEMPERATURE	AIR COOLER INLET	℃	29.0	30.0	31.0	31.0	31.0	32.0	31.0	
	AIR COOLER OUTLET	℃	-	-	-	-	-	-	-	
	L.O COOLER INLET	℃	-	-	-	-	-	-	-	
	L.O COOLER OUTLET	℃	-	-	-	-	-	-	-	
	H.T COOLER INLET	℃	-	-	-	-	-	-	-	
	H.T COOLER OUTLET	℃	-	-	-	-	-	-	-	
			-	-	-	-	-	-	-	
HGH TEMP. COOLING WATER TEMPERATURE	AIR COOLER INLET	℃	-	-	-	-	-	-	-	
	AIR COOLER OUTLET	℃	-	-	-	-	-	-	-	
	H.T ENGINE OUTLET	℃	90.0	88.0	90.0	89.0	88.0	88.0	89.0	
	H.T COOLER INLET	℃	85.0	81.0	78.0	87.0	82.0	76.0	74.0	
	H.T COOLER OUTLET	℃	-	-	-	-	-	-	-	
			-	-	-	-	-	-	-	
CHARGE AIR TEMPERATURE (A-BANK)	COOLER INLET	℃	71.0	146.0	192.0	84.0	137.0	202.0	231.0	
	COOLER OUTLET	℃	33.0	37.0	42.0	35.0	38.0	44.0	47.0	
	DIFF.PRESSURE	mmAq	-	-	-	-	-	-	-	
			-	-	-	-	-	-	-	
CHARGE AIR TEMPERATURE (B-BANK)	COOLER INLET	℃	74.0	147.0	187.0	85.0	137.0	199.0	234.0	
	COOLER OUTLET	℃	34.0	37.0	41.0	34.0	38.0	43.0	46.0	
	DIFF.PRESSURE	mmAq	-	-	-	-	-	-	-	
			-	-	-	-	-	-	-	
CHARGE AIR ENGINE INLET TEMP.		℃	-	-	-	-	-	-	-	
FUEL OIL TEMPERATURE	COOLER INLET	℃	-	-	-	-	-	-	-	
	COOLER OUTLET	℃	-	-	-	-	-	-	-	
	ENGINE INLET	℃	30.0	30.0	31.0	31.0	30.0	30.0	29.0	
LUB. OIL TEMPERATURE	COOLER INLET	℃	-	-	-	-	-	-	-	
	COOLER OUTLET	℃	-	-	-	-	-	-	-	
	ENGINE INLET	℃	64.0	64.0	64.0	64.0	65.0	65.0	65.0	
	T/C OUTLET(A-BANK)	℃	71.0	78.0	82.0	73.0	78.0	84.0	87.0	
	T/C OUTLET(B-BANK)	℃	78.0	78.0	82.0	73.0	78.0	84.0	87.0	
			-	-	-	-	-	-	-	
DYNAMOMETER L.O PRESSURE		bar	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
			-	-	-	-	-	-	-	
VIT		A	-9	25	25	-9	25	25	0.5	
		B	-9	25	25	-9	25	25	0.5	
			-	-	-	-	-	-	-	
			-	-	-	-	-	-	-	

Emission test sheet for parent engine

stx Engine

Engine type	Engine No.	Power kW	Speed rpm	No.of cyl.	Bore mm	Stroke mm	Comp Ratio
14V32/40	SB14V32-12687	6300	750	14	320	400	15.2
Fuel	**Hu kcal/kg**	**Density g/mℓ**	**Hydrogen %**	**Carbon %**	**Sulphur %**	**Nitrogen %**	**Oxygen %**
ISO-F-DMA	10270	0.829	13.8	85.61	0.01	0.01	0

Remark : IMO NOx Test E2 cycle

Mode	4	3	2	1
Load , %	25	50	75	100
Speed, %	100	100	100	100
Time at beginning of mode	11:45	11:15	10:50	10:30
Test date	2013-08-19			

Ambient Data				
Pressure, bar.abs	1.004	1.004	1.004	1.005
Temperature, ℃	35.0	35.2	36.0	34.0
Relative humidity, RH %	49.5	51.2	50.7	53.7
Absolute humidity, g/kg	17.74	18.41	17.05	16.44

Engine Data					
Engine power, kW		1575	3150	4725	6300
Engine speed, rpm		750	750	750	750
Mean effective pressure, bar		5.6	11.2	16.8	22.4
Fuel flow, kg/h		369.0	673.8	975.0	1266.0
Max. combustion pressure, bar (at cock)	A-bank	86.9	106.7	144.1	195.0
Max. combustion pressure, bar (at cock)	B-bank	88.4	109.0	146.3	195.4
Air temp. before cylinder, ℃	A-bank	35	38	44	47
Air temp. before cylinder, ℃	B-bank	34	38	43	46
Reference air temp. before cyl.(T_{SCref}), ℃		35	38	44	47
Air press. before cylinder, bar	A-bank	0.4	1.3	2.4	3.1
Air press. before cylinder, bar	B-bank	0.4	1.3	2.4	3.1
L.T cooling water temp. air cooler inlet, ℃		31	31	32	31
Exhaust gas back pressure, mmH_2O		20	80	170	240
VIT Position, mm	A-bank	-9	25.0	25.0	0.5
VIT Position, mm	B-bank	-9	25.0	25.0	0.5

Emission test sheet for parent engine

STX Engine

Engine type	Engine No.	Power kW	Speed rpm	No.of cyl.	Bore mm	Stroke mm	Comp Ratio
14V32/40	SB14V32-12687	6300	750	14	320	400	15.2
Fuel	Hu kcal/kg	Density g/㎖	Hydrogen %	Carbon %	Sulphur %	Nitrogen %	Oxygen %
ISO-F-DMA	10270	0.829	13.8	85.61	0.01	0.01	0

Remark : IMO NOx Test E2 cycle

Mode	4	3	2	1
Load , %	25	50	75	100
Speed, %	100	100	100	100
Time at beginning of mode	11:45	11:15	10:50	10:30
Test date	2013-08-19			

Emission Data				
Uncorrected spec.fuel consumption, g/kWh	234.3	213.9	206.3	201.0
Exhaust flow (GEXHW), kg/h	15938.7	28596.3	41656.0	50105.2
Air flow (GAIRW), kg/h	15569.7	27922.5	40681.0	48839.2
NOx concentration (dry), ppm	799.3	506.8	512.6	715.3
CO concnetration (dry), ppm	59.8	36.8	23.7	27.9
CO_2 concentration (dry), %	5.0	5.1	5.1	5.5
O_2 concentration (dry), %	14.0	13.9	13.9	13.2
THC concentration (wet), ppmC	163.3	168.2	141.4	128.5
Dry/wet correction factor, (KWEXH)	0.9358	0.9339	0.9332	0.9311
NOx Humi.&Temp. correction factor	1.1259	1.1370	1.1190	1.1032
NOx(15% O_2), ppm	684.3	427.1	431.4	552.0
NOx mass flow, g/h	21288	24405	35366	58390
CO mass flow, g/h	862	949	890	1257
CO_2 mass flow, g/h	1141896	2085043	3017530	3918888
O_2 mass flow, g/h	2307429	4098819	5962450	6825433
THC mass flow, g/h	1247	2304	2821	3084
NOx specific, g/kWh	13.52	7.75	7.48	9.27
CO specific, g/kWh	0.55	0.30	0.19	0.20
CO_2 specific, g/kWh	725	662	639	622
O_2 specific, g/kWh	1465	1301	1262	1083
THC specific, g/kWh	0.792	0.731	0.597	0.490
Test cycle E2 NOx specific, g/kWh	8.36	IMO TierⅡ Limit = 9.60		

Emission test sheet for parent engine

STX Engine

Engine type	Engine No.	Power kW	Speed rpm	No.of cyl.	Bore mm	Stroke mm	Comp Ratio
14V32/40	SB14V32-12687	6300	750	14	320	400	15.2
Fuel	**Hu kcal/kg**	**Density g/mℓ**	**Hydrogen %**	**Carbon %**	**Sulphur %**	**Nitrogen %**	**Oxygen %**
ISO-F-DMA	10270	0.829	13.8	85.61	0.01	0.01	0

Remark : IMO NOx Test E3 cycle

Mode	4	3	2	1
Load , %	25	50	75	100
Speed, %	63	80	91	100
Time at beginning of mode	12:40	12:20	12:00	10:30
Test date	2013-08-19			

Ambient Data				
Pressure, bar.abs	1.003	1.004	1.004	1.005
Temperature, ℃	34.9	36.9	35.5	34.0
Relative humidity, RH %	45.0	46.6	57.6	53.7
Absolute humidity, g/kg	16.01	17.41	16.32	16.44

Engine Data					
Engine power, kW		1575	3150	4725	6300
Engine speed, rpm		473	600	683	750
Mean effective pressure, bar		5.6	11.2	16.8	22.4
Fuel flow, kg/h		340.8	639.6	913.2	1266.0
Max. combustion pressure, bar (at cock)	A-bank	98.7	119.4	146.3	195.0
Max. combustion pressure, bar (at cock)	B-bank	101.1	120.9	147.7	195.4
Air temp. before cylinder, ℃	A-bank	33	37	42	47
Air temp. before cylinder, ℃	B-bank	34	37	41	46
Reference air temp. before cyl.(T_{SCref}), ℃		33	37	42	47
Air press. before cylinder, bar	A-bank	0.3	1.3	2.2	3.1
Air press. before cylinder, bar	B-bank	0.4	1.3	2.4	3.1
L.T cooling water temp. air cooler inlet, ℃		29	30	31	31
Exhaust gas back pressure, mmH_2O		10	80	130	240
VIT Position, mm	A-bank	-9	25	25	1
VIT Position, mm	B-bank	-9	25	25	1

Emission test sheet for parent engine

STX Engine

Engine type	Engine No.	Power kW	Speed rpm	No.of cyl.	Bore mm	Stroke mm	Comp Ratio
14V32/40	SB14V32-12687	6300	750	14	320	400	15.2
Fuel	**Hu kcal/kg**	**Density g/㎖**	**Hydrogen %**	**Carbon %**	**Sulphur %**	**Nitrogen %**	**Oxygen %**
ISO-F-DMA	10270	0.829	13.8	85.61	0.01	0.01	0

Remark : IMO NOx Test E3 cycle

Mode	4	3	2	1
Load , %	25	50	75	100
Speed, %	63	80	91	100
Time at beginning of mode	12:40	12:20	12:00	10:30
Test date	2013-08-19			

Emission Data				
Uncorrected spec.fuel consumption, g/kWh	216.4	203.0	193.3	201.0
Exhaust flow (GEXHW), kg/h	12617.6	29891.2	37082.6	50105.2
Air flow (GAIRW), kg/h	12276.8	29251.6	36169.4	48839.2
NOx concentration (dry), ppm	1311.6	622.1	630.0	715.3
CO concnetration (dry), ppm	307.7	38.8	25.0	27.9
CO_2 concentration (dry), %	5.89	4.65	5.40	5.53
O_2 concentration (dry), %	12.48	14.24	13.19	13.24
THC concentration (wet), ppmC	145.0	127.5	140.3	128.5
Dry/wet correction factor, (KWEXH)	0.9309	0.9380	0.9281	0.9311
NOx Humi.&Temp. correction factor	1.0998	1.1276	1.1064	1.1032
NOx(15% O_2), ppm	921.4	551.6	483.1	552.0
NOx mass flow, g/h	26872	31194	38046	58390
CO mass flow, g/h	3491	1051	831	1257
CO_2 mass flow, g/h	1050824	1980446	2823018	3918888
O_2 mass flow, g/h	1619697	4411889	5016134	6825433
THC mass flow, g/h	876	1826	2492	3084
NOx specific, g/kWh	17.06	9.90	8.05	9.27
CO specific, g/kWh	2.22	0.33	0.18	0.20
CO_2 specific, g/kWh	667	629	597	622
O_2 specific, g/kWh	1028	1401	1062	1083
THC specific, g/kWh	0.556	0.580	0.527	0.490
Test cycle E3 NOx specific, g/kWh	9.10	IMO TierⅡ Limit = 9.60		

Test cell information

STX Engine

Engine no. : SB14V32-12687

Fuel type	ISO-F-DMA				
Fuel propertis:			**Fuel elemental analysis**		
Density	0.829	g/mℓ @15℃	Carbon	85.61	% mass
Viscosity	4.30	cSt @40℃	Hydrogen	13.8	% mass
			Nitrogen	0.01	% mass
			Oxygen	0.00	% mass
			Sulphur	0.01	% mass
			LHV/Hu	10,270	kcal/kg

	Mamufacture	Model (type)	Measurement range	Calibration	
				Span gas conc.	Deviation
Analyser					
NOx Analyser	Horiba	CLA-155 (CLD)	0 - 2000 ppm	1916 ppm	-0.2%
CO Analyser	Horiba	AIA-120 (NDIR)	0 - 300 ppm	283.2 ppm	0.4%
CO_2 Analyser	Horiba	AIA-120 (NDIR)	0 - 10 %	9.46 %	-0.2%
O_2 Analyser	Horiba	MPA-120 (PMD)	0 - 25 %	23.41 %	-0.7%
THC Analyser	Horiba	FMA-126D (H.FID)	0 - 500 $ppmC_1$	437.7 $ppmC_1$	-1.2%
Speed	ONO SOKKI	HT-5100	0-30000 rpm		± 1 rpm
Power	Zollner	TY12N2N80F	0-150 kNm		± 2.5 kNm
Fuel flow	CAS	Weight type	0-1000 kg		± 3.9 kg
Air flow	Calculation based on NOx technical Code 2008 Chapter 5, Appendix 6 Carbon balance method				
Exhaust flow					
Temperature					
Ambient air	TESTO	625	-20 - 60 ℃		± 0.4 ℃
Charge air	DANFOSS	E1304028~9	0 - 120 ℃		± 0.2 ℃
Exhaust gas	DANFOSS	E1304005~22	0 - 800 ℃		± 1.8 ℃
Coolant	DANFOSS	E1304001	0 - 120 ℃		± 0.2 ℃
Fuel	DANFOSS	E1304026	-50 - 200 ℃		± 0.0 ℃
Pressure					
Ambient air	TESTO	511	945 - 1045 mbar		± 0.2 hPa
Charge air	DANFOSS	102818,30	0 - 4 bar		0.0 %
Humidity					
Ambient air	TESTO	625	20 - 100 %		± 1.7 %

Exhaust pipe	
Diameter	800 mm
Insulation	no
Probe location	18 m after turbocharger (10 m from exhaust gas exit)
Sampleing hose length	16m from sampling probe to pre-sampler
Remark	Sampling gas temperature : min. 191℃ at all loads

STX Engine

Conformity of NOx Emission ID Nos.

Engine Model	14V32/40	Engine No.	SB14V32-12687
Classification	DNV	Project No.	E13B032
Shipbuilder & Ship No.	JIANGDONG SHIPYARD / JD10000CMB-1	Date	2013-08-21
Cyl' bore & stroke (mm)	320 / 400	kW / rpm	6300 / 750

Name of Component		Quantity	Nox.Emission ID-No.	Remark
Cylinder Head		14	IMO-0845	
Connecting Rod		14	IMO-0721	
Piston	Upper Part	14	IMO-2028	
	Lower Part	14	IMO-3814	
Fuel Pump Ass'y		14	IMO-1228	
Fuel Nozzle		14	IMO-1611	
Fuel Cam Shaft		14	IMO-8046	
Air cooler		2	IMO-0720	
Turbocharger	Type	-	NR29/S172	T/C Serial No.
	Comp.wheel	2	IMO-2848	SJQ0083, SJQ0084
	Diffuser	2	IMO-0937	
	Nozzle ring	2	IMO-4442	
	Turbine rotor	2	IMO-1921	

Remarks.

Class :

Maker : H.S Kim

STX ENGINE CO., LTD. Quality Assurance Team.

STX Engine

ADJUSTMENT DATA SHEET

ENGINE No. : SB14V32-12687 DATE : 2013-08-19

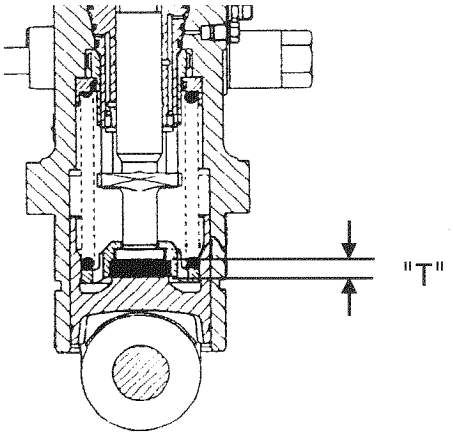
1. FUEL INJECTION PUMP

MAKER	PRETECH
PLUNGER DIAMETER	32.0 mm

2. FUEL INJECTION NOZZLE

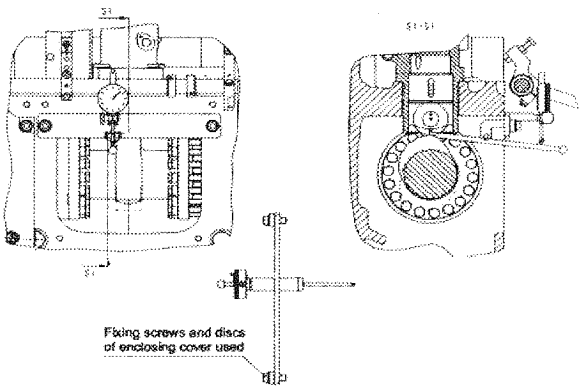
ADJUSTING OPEN PRESSURE	380 bar

3. SHIM THICKNESS OF FUEL INJECTION PUMP



CYL'NO.	(T)mm	CYL'NO.	(T)mm
A-1	11.00	B-1	10.60
A-2	11.00	B-2	10.60
A-3	11.00	B-3	11.00
A-4	11.40	B-4	11.00
A-5	11.00	B-5	11.20
A-6	11.00	B-6	11.20
A-7	11.25	B-7	11.00
A-8	-	B-8	-

4. FUEL CAM LIFT AT "TDC"



VIT POSITION: -10mm

CYL'NO.	mm	CYL'NO.	mm
A-1	10.36	B-1	10.39
A-2	10.30	B-2	10.30
A-3	10.47	B-3	10.56
A-4	10.35	B-4	10.23
A-5	10.60	B-5	10.54
A-6	10.64	B-6	10.70
A-7	10.75	B-7	10.85
A-8	-	B-8	-
Average	10.50		

Checked by : D.H.Kim

Technical File

for Turbocharger on

Engine with IMO - NOx Certification

PROJECT No. : **E13B032T**

Type of Turbocharger : **NR29/S172**

Serial No. : **SJQ 0083**

Diesel Engine

Work No.

General information about the identification of the flow parts.

The type of turbocharger and the work No. are punched in the type plate.

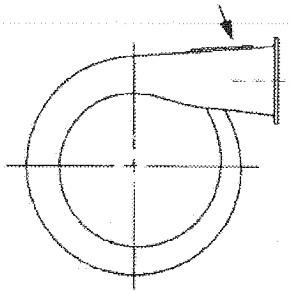
Type plate

TYPE	NR29/S172	S/N.		
n smax.	-	1/min	t max.	650 ℃
n cmax.	31300	1/min		
DATE		INSPECTION		

STX Heavy industries Co.,Ltd

The type plate is located on the outlet of the turbocharger's compressor casing.

Position of the type plate



The designation of the turbocharger type consists of three digits for NR - turbochargers and five digits for TCA and TCR - turbochargers after the slash.

This counting number stands for a special application case of the engine and defines the installed flow parts.

The thermo-dynamical properties (such as charge air pressure and air mass flow) of the turbocharger for this special engine application will be specified by following flow parts.

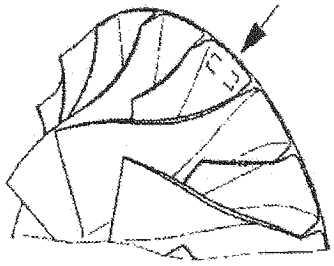
Each of these components is marked with digit IMO No., with the flow area additionally being punched into the diffuser and nozzle ring.

Type of Turbocharger : **NR29/S172** **Serial No.:** **SJQ 0083**

Position of the IMO No.

1. Compressor wheel

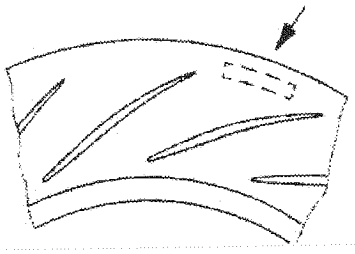
IMO No. : IMO - 2848



2. Diffuser

IMO No. : IMO - 0937

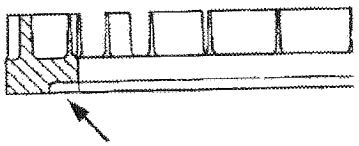
Part No.(A_{4K}) = 91.20 cm^2



3. Nozzle ring

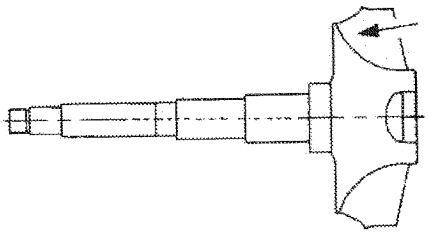
IMO No. : IMO - 4442

Part No.(A_D) = 154.75 cm^2



4. Turbine rotor

IMO No. : IMO - 1921



Date: 03/06 Prepared by: 남용진 Approved by(QA): Yong Hyun

STX Heavy industries Co., Ltd

Technical File

for Turbocharger on

Engine with IMO - NOx Certification

PROJECT No. : **E13B032T**

Type of Turbocharger : **NR29/S172**

Serial No. : **SJQ 0084**

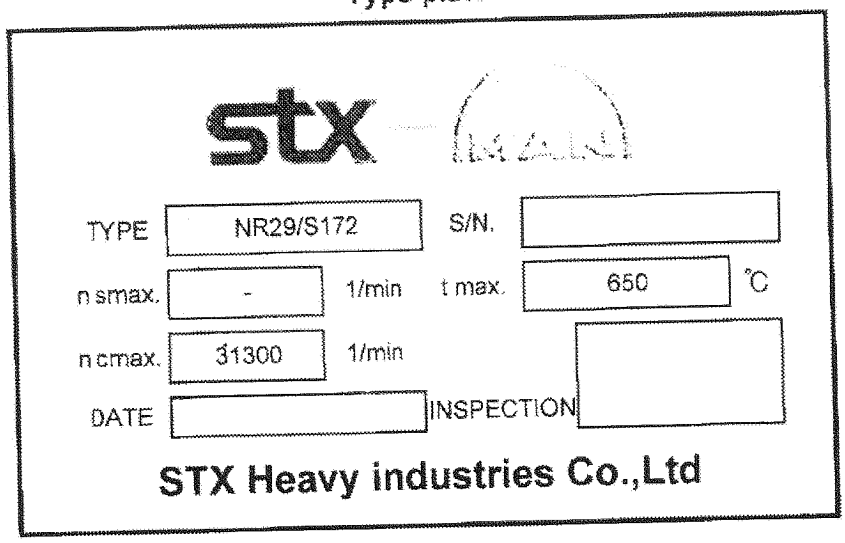
Diesel Engine

Work No.

General information about the identification of the flow parts.

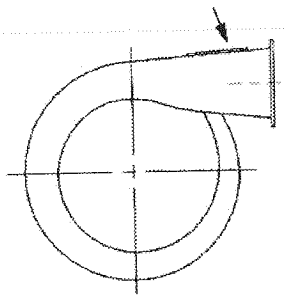
The type of turbocharger and the work No. are punched in the type plate.

Type plate



The type plate is located on the outlet of the turbocharger's compressor casing.

Position of the type plate



The designation of the turbocharger type consists of three digits for NR - turbochargers and five digits for TCA and TCR - turbochargers after the slash.

This counting number stands for a special application case of the engine and defines the installed flow parts.

The thermo-dynamical properties (such as charge air pressure and air mass flow) of the turbocharger for this special engine application will be specified by following flow parts.

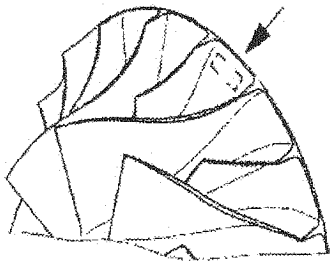
Each of these components is marked with digit IMO No., with the flow area additionally being punched into the diffuser and nozzle ring.

Type of Turbocharger : **NR29/S172** **Serial No.:** **SJQ 0084**

Position of the IMO No.

1. Compressor wheel

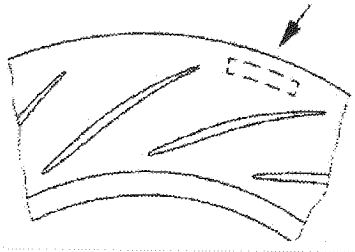
IMO No. : IMO - 2848



2. Diffuser

IMO No. : IMO - 0937

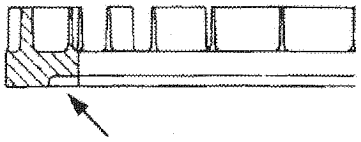
Part No.(A_{4K}) = 91.20 cm^2



3. Nozzle ring

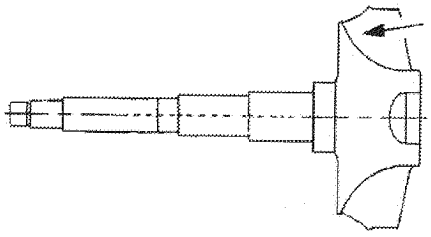
IMO No. : IMO - 4442

Part No.(A_D) = 154.75 cm^2



4. Turbine rotor

IMO No. : IMO - 1921



Date: 03/06 Prepared by: 남용진 Approved by(QA): Ryun Woong

STX Heavy industries Co., Ltd

Certificate no.:
EIAPP-1610-2-A
Date of issue:
2014-01-10

DET NORSKE VERITAS

ENGINE INTERNATIONAL AIR POLLUTION PREVENTION CERTIFICATE

This Certificate shall be supplemented by
a Record of Construction, a Technical File and Means of Verification

Issued under the provisions of the Protocol of 1997, as amended by Resolution MEPC.176(58) in 2008, to amend the International Convention for the Prevention of Pollution from Ships, 1973, as modified of the Protocol of 1978 related thereto (hereinafter referred to as "the Convention") under the authority of the Government of

LA REPÚBLICA DE PANAMÁ/ THE REPUBLIC OF PANAMA

by **Det Norske Veritas**

Particulars of engine

Engine manufacturer:	**STX Engine Co., Ltd.**
Model number:	**STX-MAN 14V32/40**
Serial number:	**SB14V32-12688**
Test cycles(s):	**E2,E3**
Rated power [kW] and speed [rpm]:	**6300 kW @ 750 rpm**
Engine approval number:	**EIAPP-G-1610-0002**

THIS IS TO CERTIFY:

1. That the above mentioned marine diesel engine has been surveyed for pre-certification in accordance with the requirements of the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines 2008 made mandatory by Annex VI of the Convention; and
2. That the pre-certification survey shows that the engine, its components, adjustable features, and technical file, prior to the engine's installation and/or service onboard a ship, fully comply with the applicable regulation 13 of Annex VI of the Convention.

Remarks/Recommendations:

This Certificate is valid for the life of the engine subject to surveys in accordance with Regulation 5 of the ANNEX VI of the Convention, installed in ships under the authority of this Government.

Issued at **Høvik** on **2014-01-10** (date)

for **Det Norske Veritas AS**

DET NORSKE VERITAS * 1864 *

Oddvar Deinboll
Head of Section

MTHO 8/8

SUPPLEMENT TO ENGINE INTERNATIONAL AIR POLLUTION PREVENTION CERTIFICATE (EIAPP CERTIFICATE)

RECORD OF CONSTRUCTION, TECHNICAL FILE AND MEANS OF VERIFICATION

Notes:

1 This Record and its attachments shall be permanently attached to the EIAPP Certificate. The EIAPP Certificate shall accompany the engine throughout its life and shall be available on board the ship at all times.

2 The Record shall be in English, French or Spanish. If an official language of the issuing country is also used, this shall prevail in case of a dispute or discrepancy.

3 Unless otherwise stated, regulations mentioned in this Record refer to regulations of Annex VI of the Convention and the requirements for an engine's technical file and means of verifications refer to mandatory requirements from the NO_X Technical Code 2008.

1. Particulars of the engine

.1 Name and address of manufacturer. **STX Engine Co., Ltd.**
80, Seongsan-dong, Changwon, Kyungsangnam-Do, Korea

.2 Place of engine build ..... **As above**

.3 Date of engine build ..... **August 2013**

.4 Place of pre-certification survey ..... **As above**

.5 Date of pre-certification survey **2013-08-22**

.6 Engine type and model number ..... **STX-MAN 14V32/40**

.7 Engine serial number **SB14V32-12688**

.8 If applicable, the engine is a parent engine [-] or a member engine [X] of the following engine family [-] or engine group [X] . **V32 45 75 E2 E3**

.9 Individual engine or engine family / engine group details:

.1 Approval reference **EIAPP-G-1610-0002**

.2 Rated power [kw] and rated speed [rpm] values or range ..... **6300 kW @ 750 rpm**

.3 Test cycle(s) **E2,E3**

.4 Parent engine(s) test fuel oil specification ..... **ISO-F-8217-DMA Grade**

.5 Applicable NOx emission limit [g/kwh], regulation **13.4** **9.6**

.6 Parent engine(s) emission value, cycle **E2,E3**, [g/kWh] **8.4**

2 Particulars of the technical file

The Technical File, as required by chapter 2 of the NOx Technical Code 2008, is an essential part of the EIAPP Certificate and must always accompany an engine throughout its life and always be available on board a ship.

.1 Technical file identification/approval number **EIAPP-G-1610-0002**

.2 Technical file approval date **2014-01-10**

3. Specifications for the onboard NO_X verification procedure

The specifications for the onboard NOx verification procedures, as required by Ch. 6 of the NOx Technical Code 2008, are an essential part of the EIAPP Certificate and must always accompany an engine throughout its life and always be available on board a ship.

.1 Engine parameter check method:

.1 Identification/approval number **EIAPP-G-1610-0002**

.2 Approval date **2014-01-10**

.2 Direct measurement and monitoring method:

.1 Identification/approval number ..... **Not applicable**

.2 Approval date ..... **Not applicable**

Alternatively the simplified measurement method in accordance with 6.3 of the NO_X Technical Code 2008 may be utilized.

THIS IS TO CERTIFY that this Record is correct in all respects:

Issued at **Høvik** on **2014-01-10** (date)

for **Det Norske Veritas AS**

Oddvar Deinboll
Head of Section