TC Amount	2				X	X	X
	3	X	X	X			
SCR	Without			X			X
	LP SCR		X			X	
	HP SCR	X			X		

Net Weight						SEQ NO	Material ID	Material Name / Dimension, Occ	Standard or Drawing	Basic Material / Material Standard	Weight GR./NET
0,001	0,001	0,001	0,001	0,001	0,001						
1	1	1	-	-	-	004	PAAD329007	Exhaust System with three turbochargers	DAAD117056		0,001
-	-	-	1	1	1	003	PAAD329000	Exhaust System with two turbochargers	DAAD117052		0,001
1	-	-	1	-	-	002	PAAD219316	SCR TURBOCHARGER PROTECTION	DAAD075623		0,001
1	-	-	1	-	-	001	PAAD219883	SCR PIPING GUIDE	DAAD064155		0,001
Quantity PER ENGINE											

Material ID					
PAAD329017	PAAD329016	PAAD329015	PAAD329014	PAAD329013	PAAD329012

Free space for lic.

Q-Code XXXXX

Standard ISO; JIS

Main Drw. H

Approved

Modif.	Number	Drawn date	Number	Drawn date	Number	Drawn date	Number	Drawn date

WIN GD Winterthur Gas & Diesel

Product W6-9X82-D

Exhaust System
Abgassystem

Units mm kg	NX		Basic Material		Net Weight
Made 03.06.2019 dki021 DH.Kim		Scale -	Size A3	Page 1/1	Material ID
Chkd 04.07.2019 wwa008 Wang		Design Group 9726	Drawing ID DAAD117063		Rev. -
Appd 05.07.2019 mhu019 Hug					

SURFACE PROTECTION SEE GROUP 0344

TOLERANCING PRINCIPLE ISO8015

GENERAL TOLERANCES ACCORDING TO ISO2768-mK

DID - DIMENSIONAL DRAWING - Confidential

Specifications which must be met:

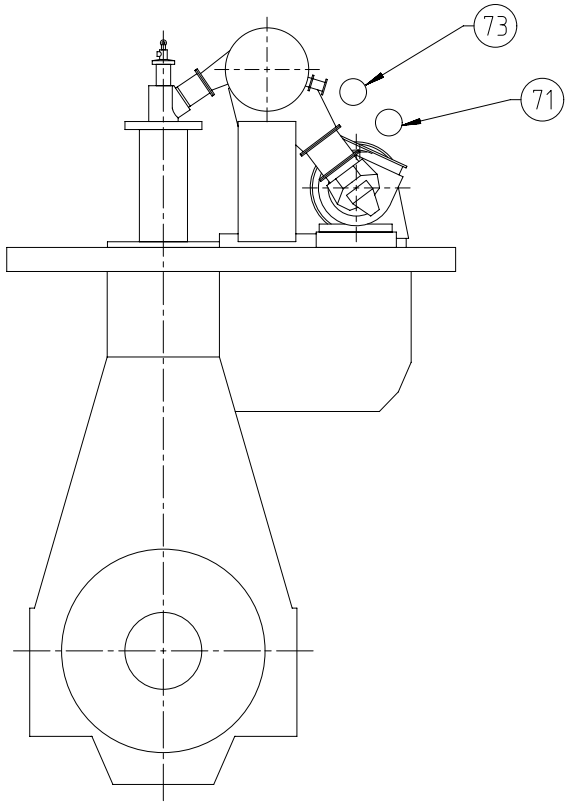
(73) OUTLET - Exhaust gas manifold waste gate

- Size of connection flange described in the pipe connection plan.
- Pipe diameter according to value B, defined on page 2.
- Waste gate connection pipe to main exhaust gas pipe should be kept as short as possible to avoid swirl and extensive back pressure.

(71) OUTLET - Exhaust gas turbocharger

- Exhaust gas temperature and volume flow: according to GTD
- The total back pressure of the exhaust gas system must be kept in the admissible range of:
  Design maximum (new condition) without exhaust gas treatment system: 30 mbar
  Design maximum (new condition) with exhaust gas treatment system: 60 mbar
  Operational maximum (fouled condition) without exhaust gas treatment system: 50 mbar
  Operational maximum (fouled condition) with exhaust gas treatment system: 80 mbar
- Pipe dimensions laid out according to the recommended gas velocities provided in the Marine Installation Manual (MIM) and by GTD.
- The exhaust piping must be arranged in a way to avoid gases from accumulating.
- The piping layout must consider the thermal expansion and vibration from turbocharger (TC) and main engine (ME). Thermal expansion of the ME to be claculated according to the formula in MIM, TC specific thermal expansion are provided by the TC supplier.
- Supports (fixation points) for carrying piping and exhaust gas system components deadweight must be installed in sufficient size and amount. In admissible tensions in the piping and forces acting on the turbocharger are not acceptable.
- Exhaust gas pipes of several engines must not be connected.
- Drains in adequate size and amount must be installed in the exhaust gas piping.
- When the noise level on the bridge wing exceeds the class requirement (normally 60 - 70 dB(A)) a silencer must be applied.
- An exhaust gas collector after the turbocharger must be installed.

X82-D



Approved

Free space for lic.							Q-Code XXXXX		Main Drw.	
							Standard ISO; JIS			
Modif.		Number	Drawn date	Number	Drawn date	Number	Drawn date	Number	Drawn date	

WIN GD Winterthur Gas & Diesel

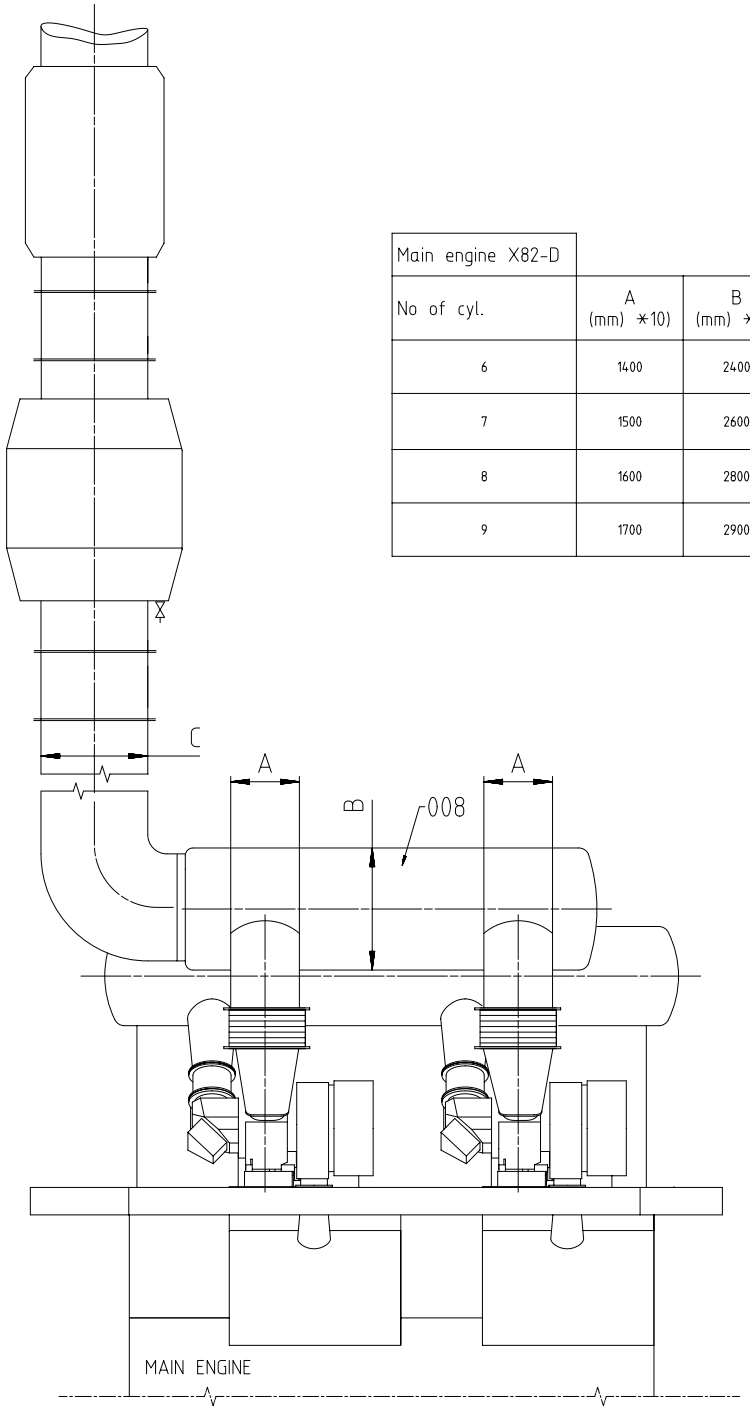
Product 6-9X82-D

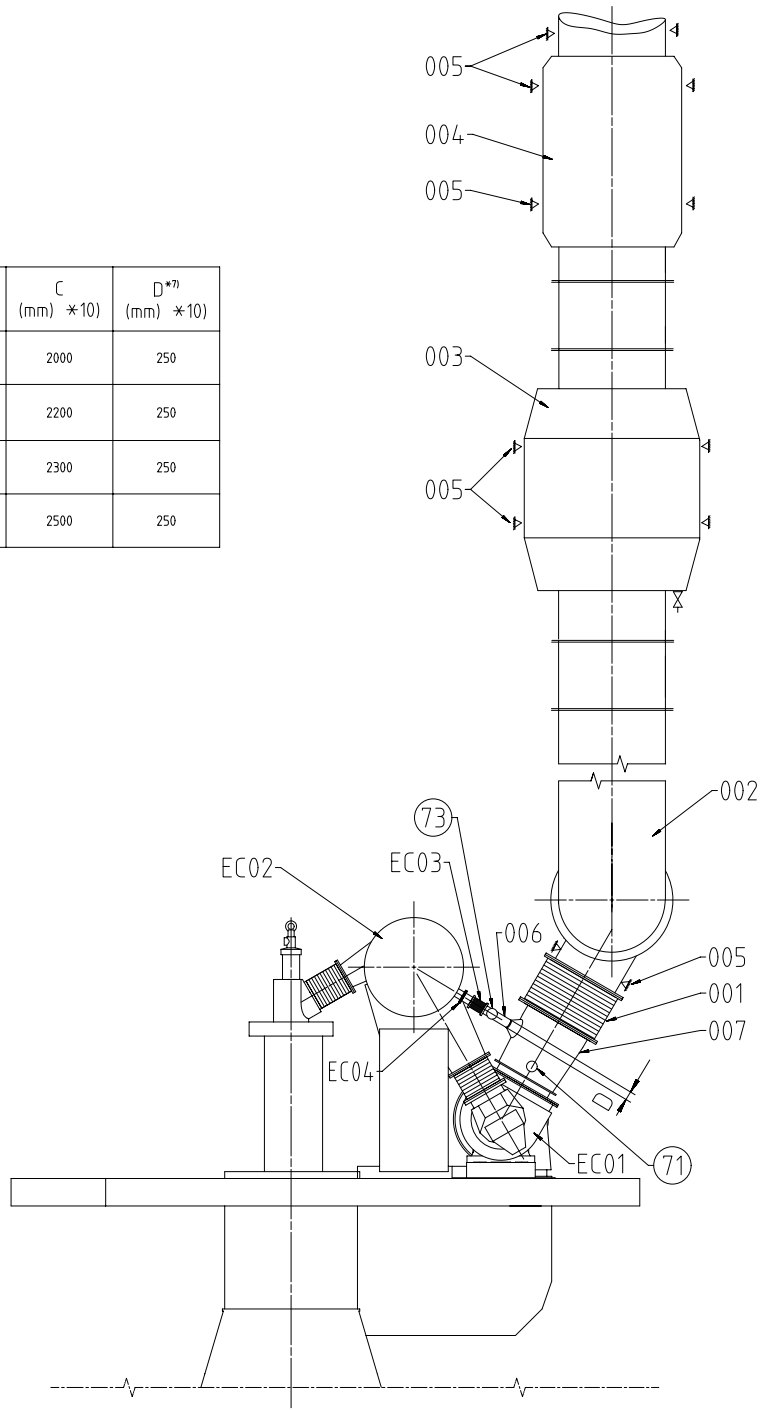
Exhaust System with two turbochargers

Units mm kg	NX	Basic Material			Net Weight 0,001
SURFACE PROTECTION SEE GROUP 0344	Made 03.06.2019 dki021 DH.Kim	Scale -	Size A3	Page 1/2	Material ID PAAD329000
TOLERANCING PRINCIPLE ISO8015	Chkd 04.07.2019 wwa008 Wang	Design Group 9726	Drawing ID DAAD117052		Rev. -
GENERAL TOLERANCES ACCORDING TO ISO2768-mK	Appd 05.07.2019 mhu019 Hug				

DID - DIMENSIONAL DRAWING - Confidential

SYSTEM PROPOSAL





Main engine X82-D				
No of cyl.	A (mm) *10)	B (mm) *10)	C (mm) *10)	D*7) (mm) *10)
6	1400	2400	2000	250
7	1500	2600	2200	250
8	1600	2800	2300	250
9	1700	2900	2500	250

Pos.	SYSTEM COMPONENTS *1)
001	Compensator *4)
002	Exhaust gas pipe
003	Boiler *9)
004	Silencer (with spark arrester) *8)
005	Support *5)
006	Waste gate pipe
007	Transition piece *6)
008	Exhaust gas collector

Pos.	ENGINE CONNECTIONS *2)
(71)	OUTLET - Exhaust gas turbocharger
(73)	OUTLET - Exhaust gas manifold waste gate

Pos.	ENGINE COMPONENTS *3)
EC01	Turbocharger
EC02	Exhaust gas manifold
EC03	Waste gate compensator *4) *7)
EC04	Waste gate valve

Remarks:

- Drain plugs and drain cocks to be installed where necessary.

*1) Refer to the "Pipe Connection Plan" for the execution and location of the engine pipe connections.

*2) To be delivered by external supplier and to be installed by the shipyard.

*3) To be delivered by the engine builder, i.e. already equipped on engine side.

*4) Dimension of expansion piece (compensator) must be defined by the shipyard taking into account the thermal growth of exhaust manifold and exhaust pipe.
Vibrations of the pipe after the compensator must be lower than 45 mm/s RMS (root mean square).

*5) Installed as fixed or sliding type in accordance with the requirements. Final amount and position have to be defined by the shipyard under consideration of system layout and requirements based on installation specific calculation.

*6) Area ratio between outlet/inlet diameter = 1.1...1.6
Taper angle ≤ 40°

*7) Pipe dimension on engine side (before compensator) is one nominal pipe size smaller.

*8) Optional, installed as required to meet noise requirements.

*9) Optional. When waste heat recovery (WHR) with steam and/or power driven turbine is applied a large exhaust gas bypass flow rate is expected. In that case a silencer must be installed after the boiler in order to keep the noise level within the permissible range.

*10) The provided dimensions refer to an R1 rated engine and serve just as proposal. To make the project specific layout, data as provided by GTD and by the turbocharger supplier must be taken into account.

Free space for lic.
Q-Code XXXXX
Standard ISO; JIS
Main Drw.

Modif.	Number	Drawn date	Number	Drawn date	Number	Drawn date	Number	Drawn date

WIN GD Winterthur Gas & Diesel

Product 6-9X82-D

Exhaust System with two turbochargers

Units mm kg | NX | Basic Material | Net Weight 0,001

SURFACE PROTECTION SEE GROUP 0344	Made	03.06.2019	dki021 DH.Kim	Scale -	Size A1	Page 2/2	Material ID PAAD329000
TOLERANCING PRINCIPLE ISO8015	Chkd	04.07.2019	wwa008 Wang	Design Group 9726	Drawing ID DAAD117052		Rev. -
GENERAL TOLERANCES ACCORDING TO ISO2768-mK	Appd	05.07.2019	mhu019 Hug				

DIG - DIMENSIONAL DRAWING - Confidential

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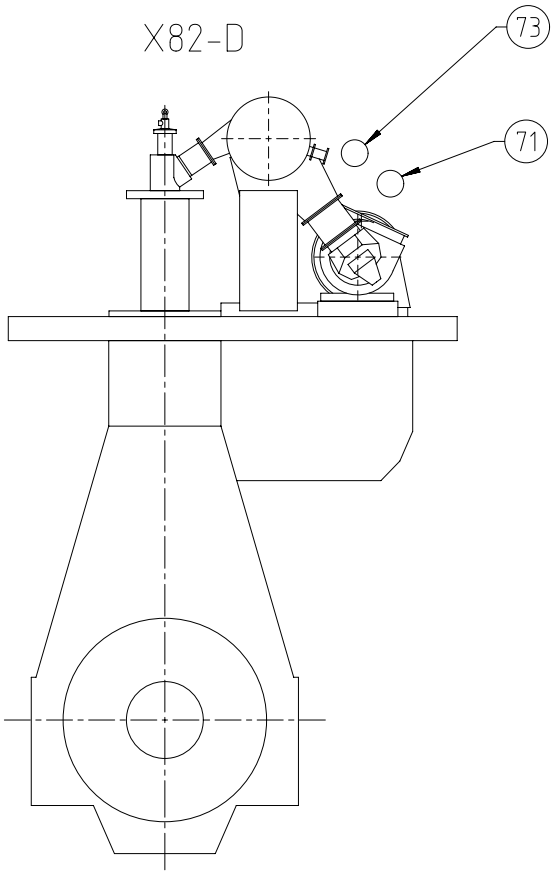
Specifications which must be met:

(73) OUTLET - Exhaust gas manifold waste gate

- Size of connection flange described in the pipe connection plan.
- Pipe diameter according to value B, defined on page 2.
- Waste gate connection pipe to main exhaust gas pipe should be kept as short as possible to avoid swirl and extensive back pressure.

X82-D



(71) OUTLET - Exhaust gas turbocharger

- Exhaust gas temperature and volume flow: according to GTD
- The total back pressure of the exhaust gas system must be kept in the admissible range of:
  Design maximum (new condition) without exhaust gas treatment system: 30 mbar
  Design maximum (new condition) with exhaust gas treatment system: 60 mbar
  Operational maximum (fouled condition) without exhaust gas treatment system: 50 mbar
  Operational maximum (fouled condition) with exhaust gas treatment system: 80 mbar
- Pipe dimensions laid out according to the recommended gas velocities provided in the Marine Installation Manual (MIM) and by GTD.
- The exhaust piping must be arranged in a way to avoid gases from accumulating.
- The piping layout must consider the thermal expansion and vibration from turbocharger (TC) and main engine (ME). Thermal expansion of the ME to be claculated according to the formula in MIM, TC specific thermal expansion are provided by the TC supplier.
- Supports (fixation points) for carrying piping and exhaust gas system components deadweight must be installed in sufficient size and amount. In admissible tensions in the piping and forces acting on the turbocharger are not acceptable.
- Exhaust gas pipes of several engines must not be connected.
- Drains in adequate size and amount must be installed in the exhaust gas piping.
- When the noise level on the bridge wing exceeds the class requirement (normally 60 - 70 dB(A)) a silencer must be applied.
- An exhaust gas collector after the turbocharger must be installed.

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Free space for lic.									Q-Code XXXXX		Main Drw.
									Standard ISO; JIS		
Modif.		Number	Drawn date		Number	Drawn date		Number	Drawn date		Number	Drawn date

WIN GD Winterthur Gas & Diesel

Product 9X82-D

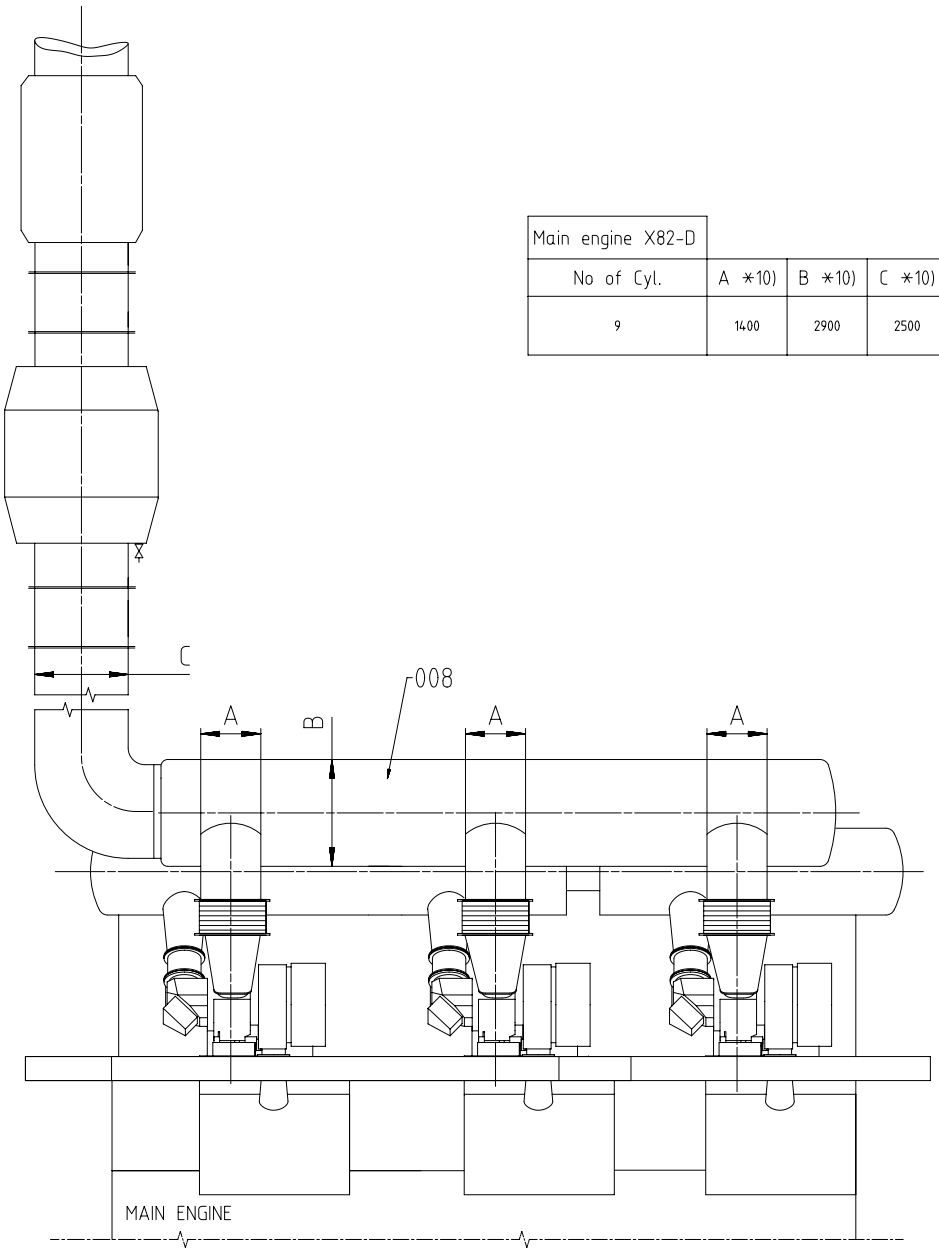
Exhaust System with three turbochargers

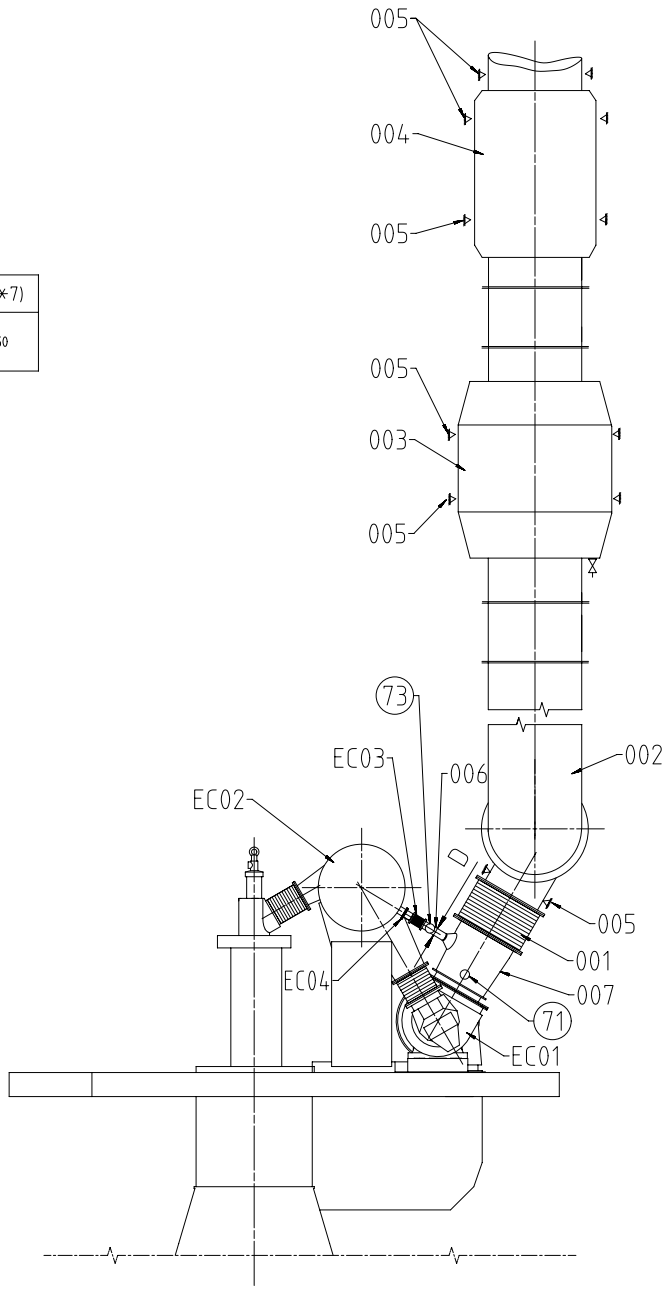
Units mm kg	NX	Basic Material			Net Weight 0,001
SURFACE PROTECTION SEE GROUP 0344	Made 03.06.2019 dki021 DH.Kim	Scale -	Size A3	Page 1/2	Material ID PAAD329007
TOLERANCING PRINCIPLE ISO8015	Chkd 04.07.2019 wwa008 Wang	Design Group 9726	Drawing ID DAAD117056		Rev. -
GENERAL TOLERANCES ACCORDING TO ISO2768-mK	Appd 05.07.2019 mhu019 Hug				

DID - DIMENSIONAL DRAWING - Confidential

SYSTEM PROPOSAL

Main engine X82-D				
No of Cyl.	A *10)	B *10)	C *10)	D *7)
9	1400	2900	2500	250





Pos.	SYSTEM COMPONENTS *1)
001	Compensator *4)
002	Exhaust gas pipe
003	Boiler *9)
004	Silencer (with spark arrester) *8)
005	Support *5)
006	Waste gate pipe
007	Transition piece *6)
008	Exhaust gas collector

Pos.	ENGINE CONNECTIONS *2)
(71)	OUTLET - Exhaust gas turbocharger
(73)	OUTLET - Exhaust gas manifold waste gate

Pos.	ENGINE COMPONENTS *3)
EC01	Turbocharger
EC02	Exhaust gas manifold
EC03	Waste gate compensator *4) *7)
EC04	Waste gate valve

Remarks:

- Drain plugs and drain cocks to be installed where necessary.

*1) Refer to the "Pipe Connection Plan" for the execution and location of the engine pipe connections.

*2) To be delivered by external supplier and to be installed by the shipyard.

*3) To be delivered by the engine builder, i.e. already equipped on engine side.

*4) Dimension of expansion piece (compensator) must be defined by the shipyard taking into account the thermal growth of exhaust manifold and exhaust pipe.
Vibrations of the pipe after the compensator must be lower than 45 mm/s RMS (root mean square).

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*6) Area ratio between outlet/inlet diameter = 1.1...1.6
Taper angle $\leq$ 40°

*7) Pipe dimension on engine side (before compensator) is one nominal pipe size smaller.

*8) Optional, installed as required to meet noise requirements.

*9) Optional. When waste heat recovery (WHR) with steam and/or power driven turbine is applied a large exhaust gas bypass flow rate is expected. In that case a silencer must be installed after the boiler in order to keep the noise level within the permissible range.

*10) The provided dimensions refer to an R1 rated engine and serve just as proposal. To make the project specific layout, data as provided by GTD and by the turbocharger supplier must be taken into account.

Free space for lic.
Q-Code XXXXX
Standard ISO; JIS
Main Drw.

Modif.	Number	Drawn date	Number	Drawn date	Number	Drawn date	Number	Drawn date

WIN GD Winterthur Gas & Diesel

Product 9X82-D

Exhaust System
with three turbochargers

Units mm kg | NX | Basic Material | Net Weight 0,001

SURFACE PROTECTION SEE GROUP 0344	Made	03.06.2019	dki021	DH.Kim	Scale –
TOLERANCING PRINCIPLE ISO8015	Chkd	04.07.2019	wwa008	Wang	Design Group 9726
GENERAL TOLERANCES ACCORDING TO ISO2768-mK	Appd	05.07.2019	mhu019	Hug	Drawing ID DAAD117056

Size A1 | Page 2/2 | Material ID PAAD329007 | Rev. –

Approved

WinGD X82-2.0 – Exhaust System (DG9726)

TRACK CHANGES

DATE	SUBJECT	DESCRIPTION
2019-07-12	DRAWING SET	First web upload

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Winterthur Gas & Diesel S.A.

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