TC Amount			
	1		X
	2	X	

Net Weight 0,001	Net Weight 0,002	SEQ NO	Material ID	Material Name / Dimension, Occ	Standard or Drawing	Basic Material / Material Standard	Weight GR./NET
1	1	003	PAAD327310	SPECIFICATION for waste gate selection	DAAD116127		0,001
1	-	002	PAAD379336	Exhaust System with two turbochargers	DAAD142412		0,001
-	1	001	PAAD379351	Exhaust System with one turbocharger	DAAD142417		0,001

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Quantity PER ENGINE											
PAAD379364	PAAD379363	Free space for lic.								Q-Code XXXXX	Main Drw. H
Material ID		Modif.	Number	Drawn date	Number	Drawn date	Number	Drawn date	Number	Drawn date	Standard ISO; JIS

WIN GD Winterthur Gas & Diesel

Product W5-8X52DF-S1.0

Exhaust System
Abgassystem

Units	mm kg	NX	Basic Material	Net Weight
Made	23.04.2021 dki021 DH.Kim	Scale -	Size A3	Page 1/1	Material ID
Chkd	23.04.2021 jpi101 Pickup	Design Group 9726	Drawing ID DAAD142422	Rev. -
Appd	23.04.2021 mhu019 Hug			

SURFACE PROTECTION SEE GROUP 0344
TOLERANCING PRINCIPLE ISO8015
GENERAL TOLERANCES ACCORDING TO ISO2768-mK

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Specification which must be met:

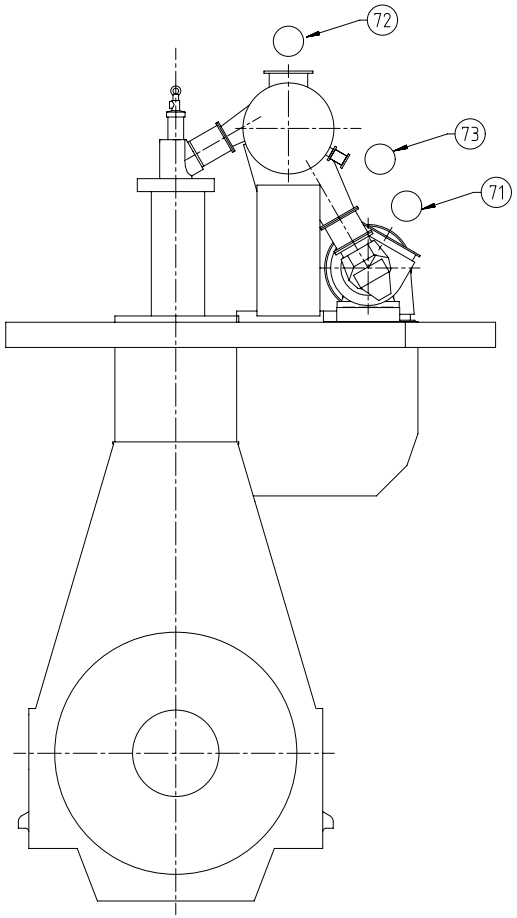
(72) OUTLET - Exhaust gas by-pass

- The installation of a by-pass line between exhaust gas manifold and turbocharger may be requested by owner and class if only one turbocharger is installed.
  Its purpose is to allow engine operation even after a turbocharger failure.
- Blinded off during normal operation.

(73) OUTLET - Exhaust gas manifold waste gate

- Size and layout of connection flange is provided in the "Pipe Connection Plan"
- Pipe diameter according to parameter "B" on page 2.
- Waste gate connection pipe to main exhaust gas pipe must be kept as short as possible to avoid swirl and extensive back pressure.

X52DF-S1.0



(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) in gas mode and in diesel mode without exhaust gas treatment system: 30 mbar
  Design maximum (new condition) in diesel mode with low pressure exhaust gas treatment system: 60 mbar
  Operational maximum in gas mode: 45 mbar
  Operational maximum (fouled condition) in diesel mode without exhaust gas treatment system: 50 mbar
  Operational maximum (fouled condition) in diesel mode with low pressure 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 with cones, bends and pipe connections must be flow optimised and 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 is to be calculated according to the formula in MIM, TC specific thermal expansion are provided by the TC supplier.
- Explosion relief devices, examined and certified by the maker, with flameless pressure relief (rupture discs outside of the engine room or self-closing, spring loaded valves) must be selected and installed within the exhaust system in accordance with class requirements.
  The position and number of explosion relief devices must be determined by the system designer or the shipyard through calculation.
- A continuous (extensive) exhaust gas leakage must be avoided.
- Supports (fixation points) for carrying piping and exhaust gas system components deadweight must be installed in sufficient size and amount.
  Inadmissible 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.

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	Number	Drawn date	

WIN GD Winterthur Gas & Diesel

Product 5-7X52DF-S1.0

Exhaust System with one turbocharger

Units mm kg	NX		Basic Material			Net Weight 0,001
SURFACE PROTECTION SEE GROUP 0344	Made	08.04.2021 dki021 DH.Kim	Scale –	Size A2	Page 1/2	Material ID PAAD379351
TOLERANCING PRINCIPLE ISO8015	Chkd	23.04.2021 jpi101 Pickup	Design Group 9726	Drawing ID DAAD142417		Rev. –
GENERAL TOLERANCES ACCORDING TO ISO2768-mK	Appd	23.04.2021 mhu019 Hug				

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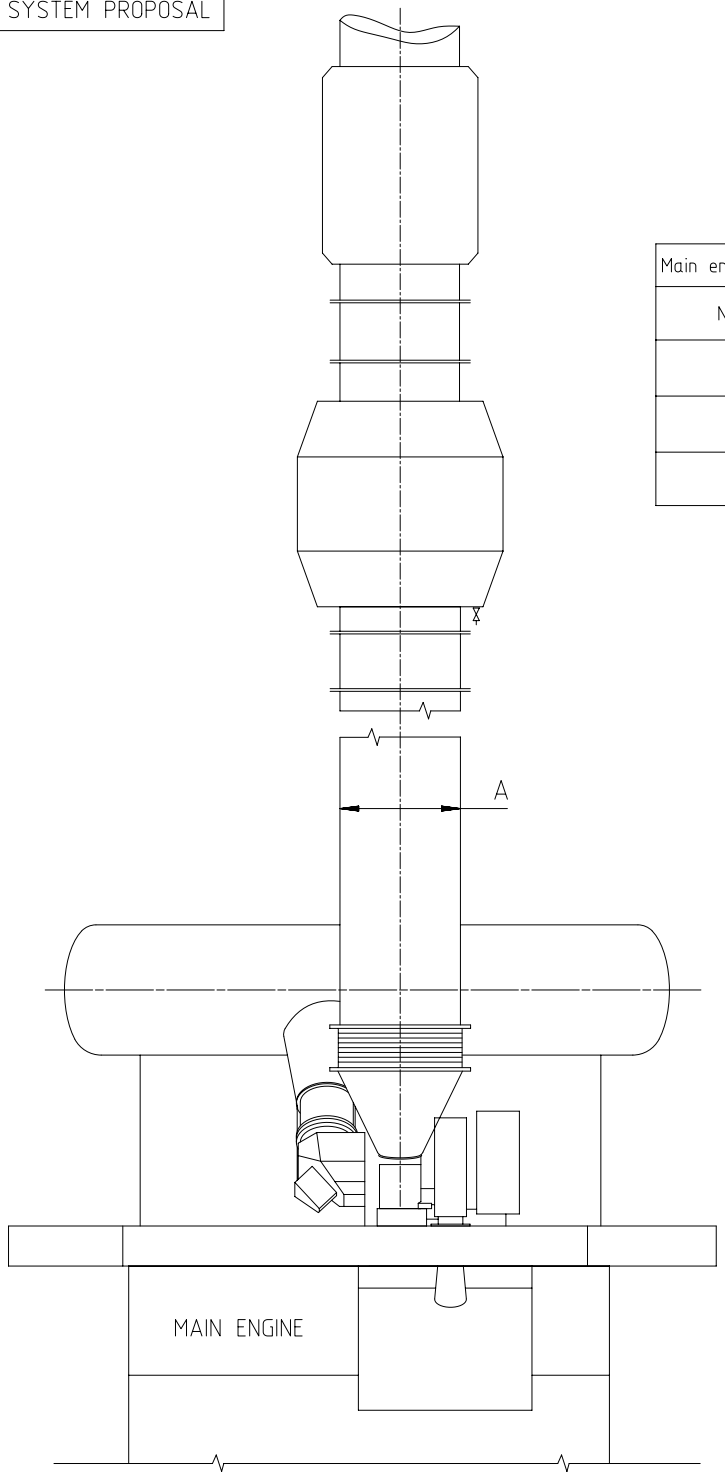
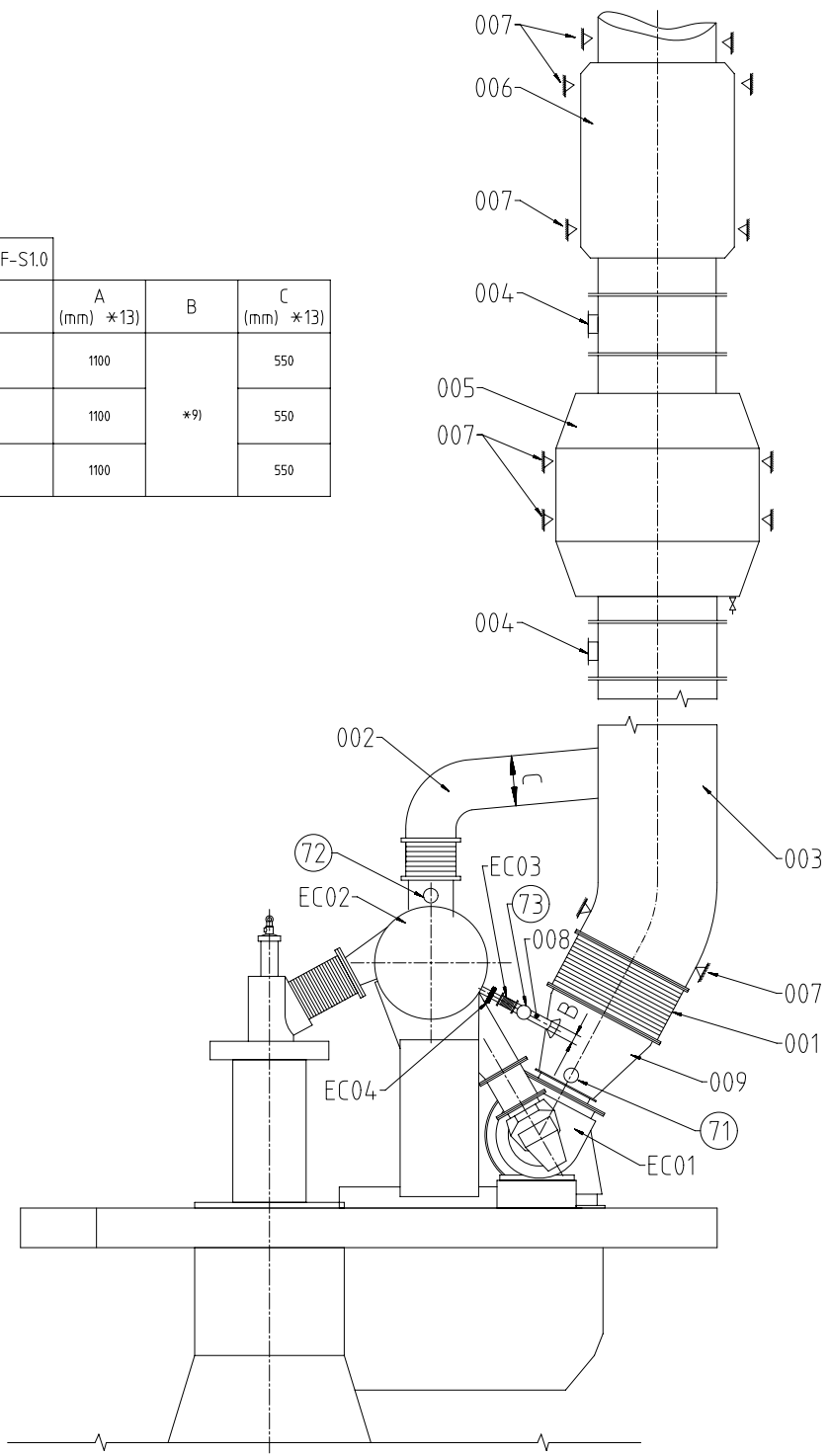
SYSTEM PROPOSAL



Main engine X52DF-S1.0			
No of Cyl.	A (mm) *13)	B	C (mm) *13)
5	1100	*9)	550
6	1100		550
7	1100		550



Pos.	SYSTEM COMPONENTS *1)
001	Compensator *4)
002	Exhaust gas by-pass line *8)
003	Exhaust gas pipe *12)
004	Explosion relief device (rupture discs or spring loaded valves) *5)
005	Boiler *11)
006	Silencer (with spark arrester) *10)
007	Support *6)
008	Waste gate pipe
009	Transition piece *7)

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

Pos.	ENGINE COMPONENTS *3)
EC01	Turbocharger
EC02	Exhaust gas manifold
EC03	Waste gate compensator *4) *9)
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 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) When rupture discs are installed outside of the engine room, preventative measures must be taken to ensure that exhaust gas does not continuously flow to the outside after rupture. This can be achieved with an exhaust gas duct leading to the open deck, or in the case of a twin-engine installation by sending a control signal that triggers a shutdown of the engine. If either of these options are not possible, a self-closing, spring loaded valve must be used. This would remove the peak pressure of an explosion, while ensuring that the exhaust gas does not continuously flow outside.
*6) The piping of the exhaust gas system must be structurally supported to withstand the mass and to minimise vibrations across the system. It is suggested that this is achieved by supports which are connected to the ship hull or otherwise. The type of these supports (fixed or sliding type), their final amount, and position must be defined by the shipyard under consideration of system layout and requirements based on installation specific calculation.
*7) Area ratio between outlet/inlet diameter = 1.1...1.6
Taper angle ∠ 40°
*8) Optional, needs just to be installed if requested by owner and class to ensure engine operation even after a turbocharger failure.
*9) Guidance regarding the selection of the waste gate pipe size is provided by the drawing "DAAD116127" as linked on the main drawing of this design group. The waste gate pipe on the shipside is one nominal pipe size larger than the waste gate pipe on the engine side (before the compensator).
*10) Optional, installed as required to meet noise requirements.
*11) Optional.
*12) The radius of pipe bends should be not smaller than 1.5 x DN.
*13) 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 5-7X52DF-S1.0

Exhaust System with one turbocharger

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

SURFACE PROTECTION SEE GROUP 0344	Made	08.04.2021	dki021	DH.Kim	Scale -	Size A1	Page 2/2	Material ID PAAD379351
TOLERANCING PRINCIPLE ISO8015	Chkd	23.04.2021	jpi101	Pickup	Design Group 9726	Drawing ID DAAD142417		Rev. -
GENERAL TOLERANCES ACCORDING TO ISO2768-mK	Appd	23.04.2021	mhu019	Hug				

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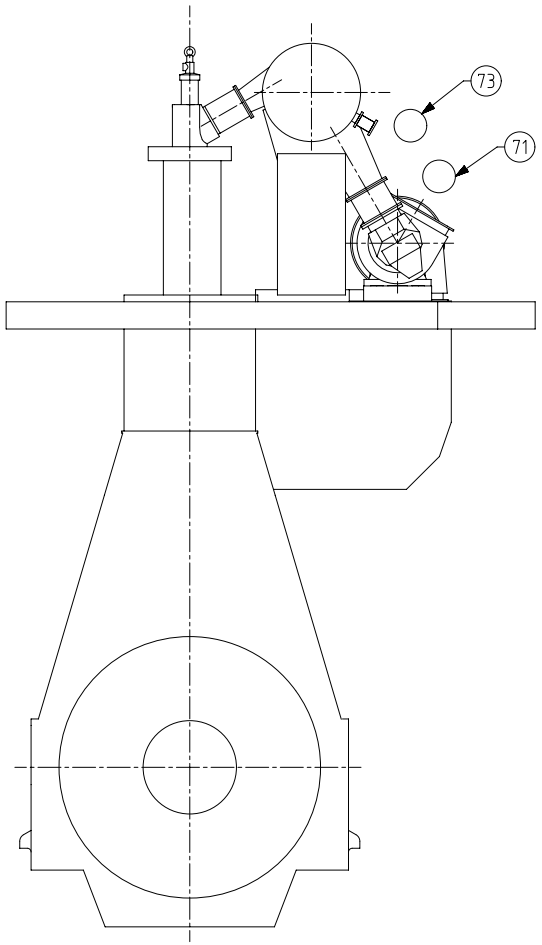
Specification which must be met:

(73) OUTLET - Exhaust gas manifold waste gate

- Size and layout of connection flange is provided in the "Pipe Connection Plan"
- Pipe diameter according to parameter "B" on page 2.
- Waste gate connection pipe to main exhaust gas pipe must be kept as short as possible to avoid swirl and extensive back pressure.

X52DF-S1.0



(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) in gas mode and in diesel mode without exhaust gas treatment system: 30 mbar
  Design maximum (new condition) in diesel mode with low pressure exhaust gas treatment system: 60 mbar
  Operational maximum in gas mode: 45 mbar
  Operational maximum (fouled condition) in diesel mode without exhaust gas treatment system: 50 mbar
  Operational maximum (fouled condition) in diesel mode with low pressure 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 with cones, bends and pipe connections must be flow optimised and 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 is to be calculated according to the formula in MIM, TC specific thermal expansion are provided by the TC supplier.
- Explosion relief devices, examined and certified by the maker, with flameless pressure relief (rupture discs outside of the engine room or self-closing, spring loaded valves) must be selected and installed within the exhaust system in accordance with class requirements.
  The position and number of explosion relief devices must be determined by the system designer or the shipyard through calculation.
- A continuous (extensive) exhaust gas leakage must be avoided.
- Supports (fixation points) for carrying piping and exhaust gas system components deadweight must be installed in sufficient size and amount.
  Inadmissible 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.

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 7-8X52DF-S1.0	Exhaust System with two turbocharger	
Units mm kg	NX	Basic Material	Net Weight 0,001

SURFACE PROTECTION SEE GROUP 0344	Made 08.04.2021 dki021 DH.Kim	Scale –	Size A2	Page 1/2	Material ID PAAD379336
TOLERANCING PRINCIPLE ISO8015	Chkd 23.04.2021 jpi101 Pickup	Design Group 9726	Drawing ID DAAD142412		Rev. –
GENERAL TOLERANCES ACCORDING TO ISO2768-mK	Appd 23.04.2021 mhu019 Hug				

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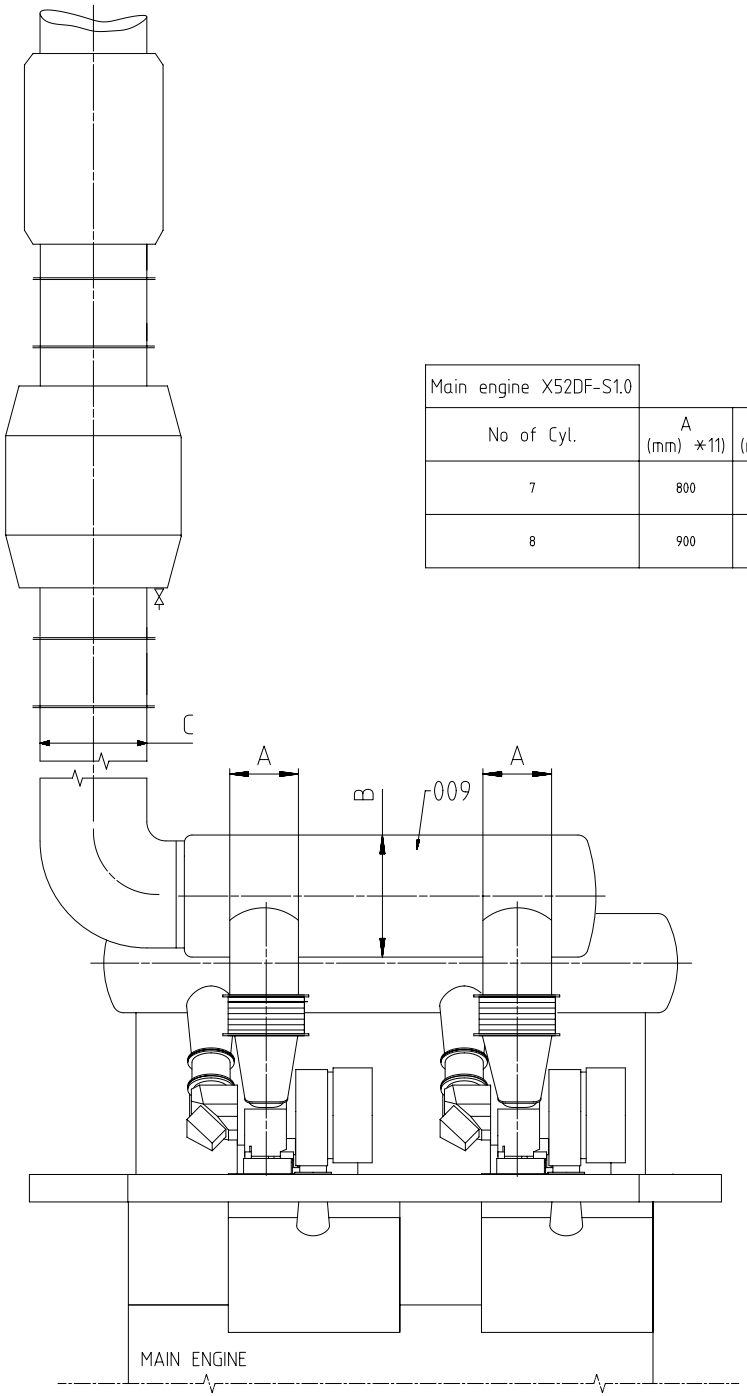
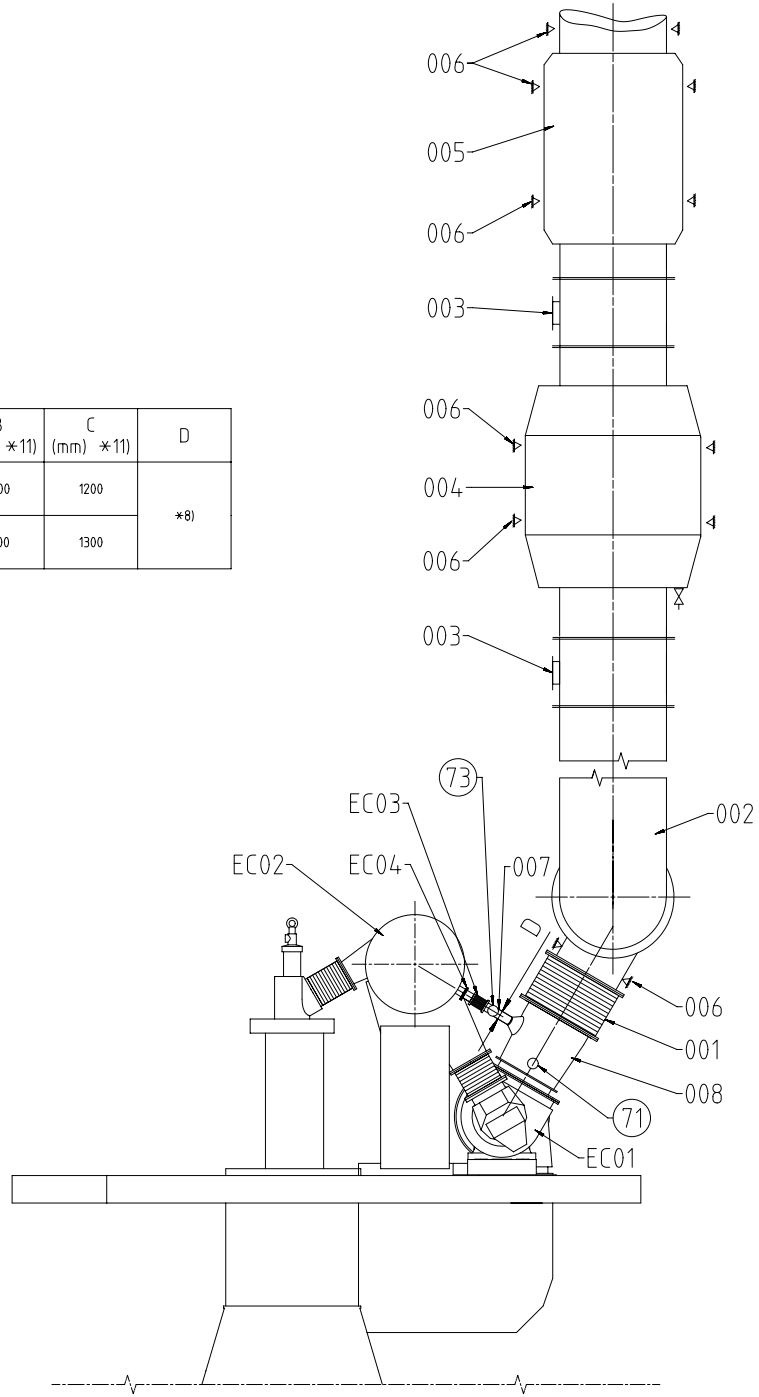
SYSTEM PROPOSAL



Main engine X52DF-S1.0				
No of Cyl.	A (mm) *11)	B (mm) *11)	C (mm) *11)	D
7	800	1400	1200	*8)
8	900	1500	1300	



Pos.	SYSTEM COMPONENTS *1)
001	Compensator *4)
002	Exhaust gas pipe *12)
003	Explosion relief device (rupture discs or spring loaded valves) *5)
004	Boiler *10)
005	Silencer (with spark arrester) *9)
006	Support *6)
007	Waste gate pipe
008	Transition piece *7)
009	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) *8)
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 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) When rupture discs are installed outside of the engine room, preventative measures must be taken to ensure that exhaust gas does not continuously flow to the outside after rupture. This can be achieved with an exhaust gas duct leading to the open deck, or in the case of a twin-engine installation by sending a control signal that triggers a shutdown of the engine. If either of these options are not possible, a self-closing, spring loaded valve must be used. This would remove the peak pressure of an explosion, while ensuring that the exhaust gas does not continuously flow outside.

*6) The piping of the exhaust gas system must be structurally supported to withstand the mass and to minimise vibrations across the system.
It is suggested that this is achieved by supports which are connected to the ship hull or otherwise. The type of these supports (fixed or sliding type), their final amount, and position must be defined by the shipyard under consideration of system layout and requirements based on installation specific calculation.

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

*8) Guidance regarding the selection of the waste gate pipe size is provided by the drawing "DAAD116127" as linked on the main drawing of this design group. The waste gate pipe on the shipside is one nominal pipe size larger than the waste gate pipe on the engine side (before the compensator).

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

*10) Optional.

*11) 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.

*12) The radius of pipe bends should be not smaller than 1.5 x DN

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 7-8X52DF-S1.0

Exhaust System with two turbocharger

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

SURFACE PROTECTION SEE GROUP 0344	Made	08.04.2021	dki021	DH.Kim	Scale -	Size A1
TOLERANCING PRINCIPLE ISO8015	Chkd	23.04.2021	jpi101	Pickup	Design Group 9726	Page 2/2
GENERAL TOLERANCES ACCORDING TO ISO2768-mK	Appd	23.04.2021	mhu019	Hug	Drawing ID DAAD142412	Material ID PAAD379336 Rev. -

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Valve sizes

Engines	X35				X40				RT-Flex50				X52				X52-S (A)				RT-flex58T-E and X62				X62-S (A)				X72				X82				X92							
Cylinders	5	6	7	8	5	6	7	8	5	6	7	8	5	6	7	8	5	6	7	8	5	6	7	8	5	6	7	8	5	6	7	8	6	7	8	9	6	7	8	9	10	11	12
Diesel	80	80	80	80	80	80	100	100	100	100	125	125	100	100	125	125	100	125	125	125	125	125	150	150	125	125	150	150	150	150	150	200	200	200	200	200	200	200	250	250	250	250	250
DF FPP	100	100	125	125	100	125	125	125	125	125	150	150	125	125	150	150	125	125	150	150	150	200	200	200	150	200	200	200	200	200	200	250	250	250	250	250	250	250	300	300	300	350	350
DF CPP	125	125	125	150	125	150	150	150	150	150	200	200	150	150	200	200	150	150	200	200	200	200	250	250	200	200	200	250	200	250	250	250											(A)

Flange dimensions on the manifold

Flange DN	200	200	200	200	200	200	200	200	250	250	250	250	250	250	250	250	250	250	250	250	300	300	300	300	300	300	300	300	300	300	300	300	400	400	400	400	450	450	450	450	450	450	450

Pipe dimensions after the valve for the yard connection

Valve DN	80	100	125	150	200	250	300	350	400	450	500
Pipe DN	100	125	150	200	250	300	350	400	450	500	600

List is valid for portfolio engines including B variants and DF
Engine sizes not listed here - on request
For LLT and DBT orifices will still have dimension D based on tuning sheets - SEE DG.0800

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
A	EAAD092014	07.01.2020						

WIN GD Winterthur Gas & Diesel

Product W-2S

SPECIFICATION
EXHAUST WASTE GATE SELECTION
Spezifikation
Abgas-Abblaseventil Selektion

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

SURFACE PROTECTION SEE GROUP 0344	Made	13.05.2019 mli102 Lipska	Scale 1:1	Size A2	Page 1/1	Material ID PAAD327310
TOLERANCING PRINCIPLE ISO8015	Chkd	29.05.2019 rla101 Lapcevic	Design Group 8135	Drawing ID DAAD116127		Rev. A
GENERAL TOLERANCES ACCORDING TO ISO2768-mK	Appd	04.06.2019 mgr026 Graf				

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MIDS - WinGD X52DF-S1.0 – Exhaust System (DG9726)

TRACK CHANGES

DATE	SUBJECT	DESCRIPTION
2021-05-10	DRAWING SET	First web upload

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