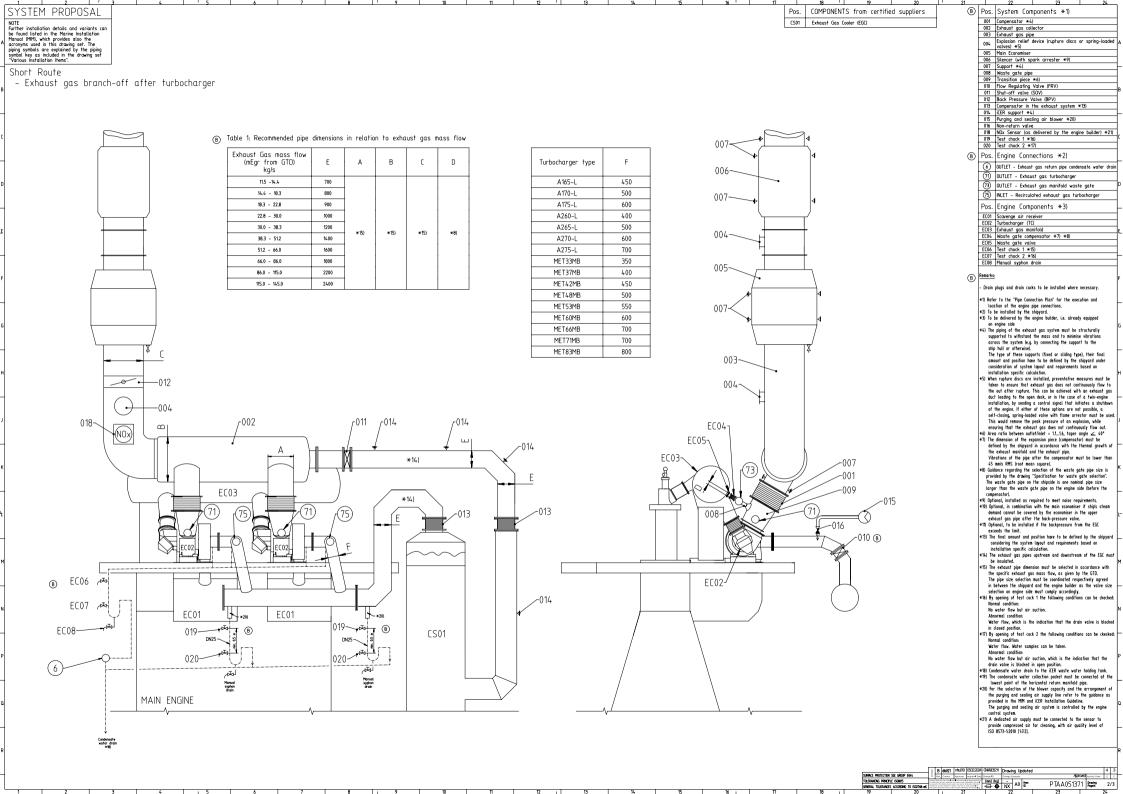
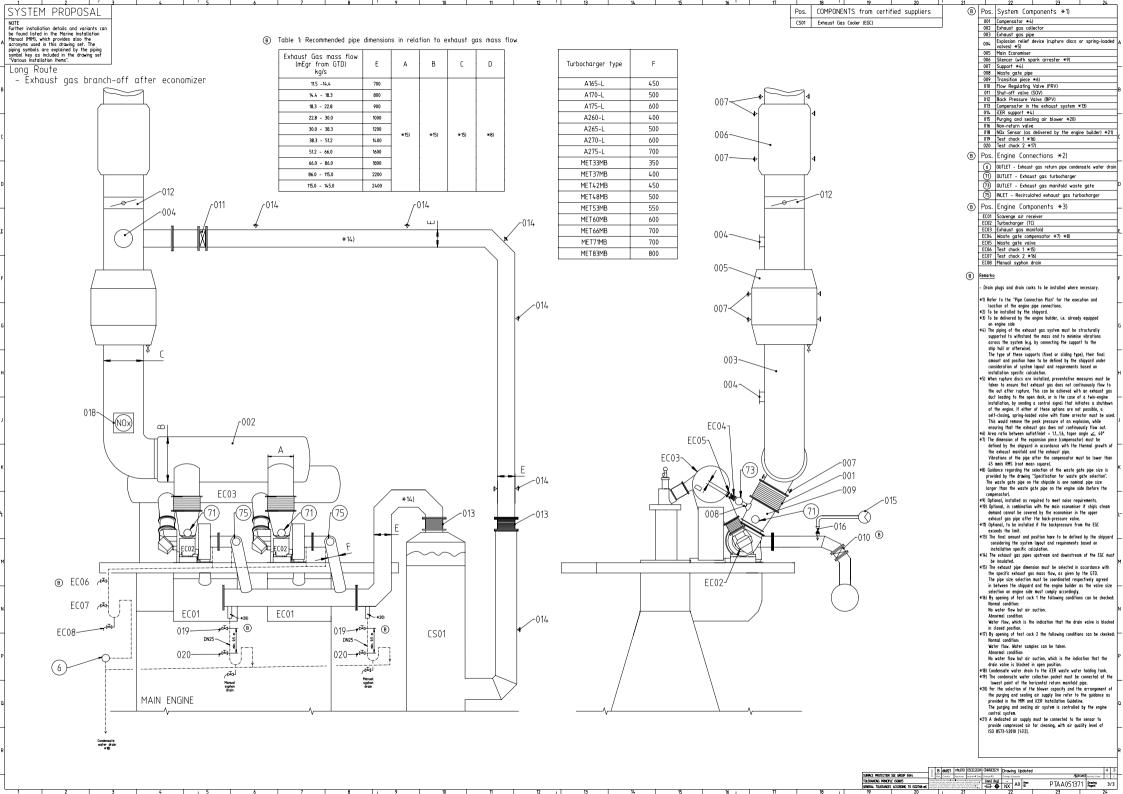
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SEQ NO	QTY	Item ID		Item Name				Dimension	Standard-ID	Basic Materia	l		Net Weight
1	1	PTAA)51371	Exhaust Syste	em		wit	h two turbocharger					0
2	1	PAAD	327310	SPECIFICATI	ON								0.001
3	1		139643	GUIDELINES		FUR	VASIEG	GATE SELECTION					
3		DAAD	139043										
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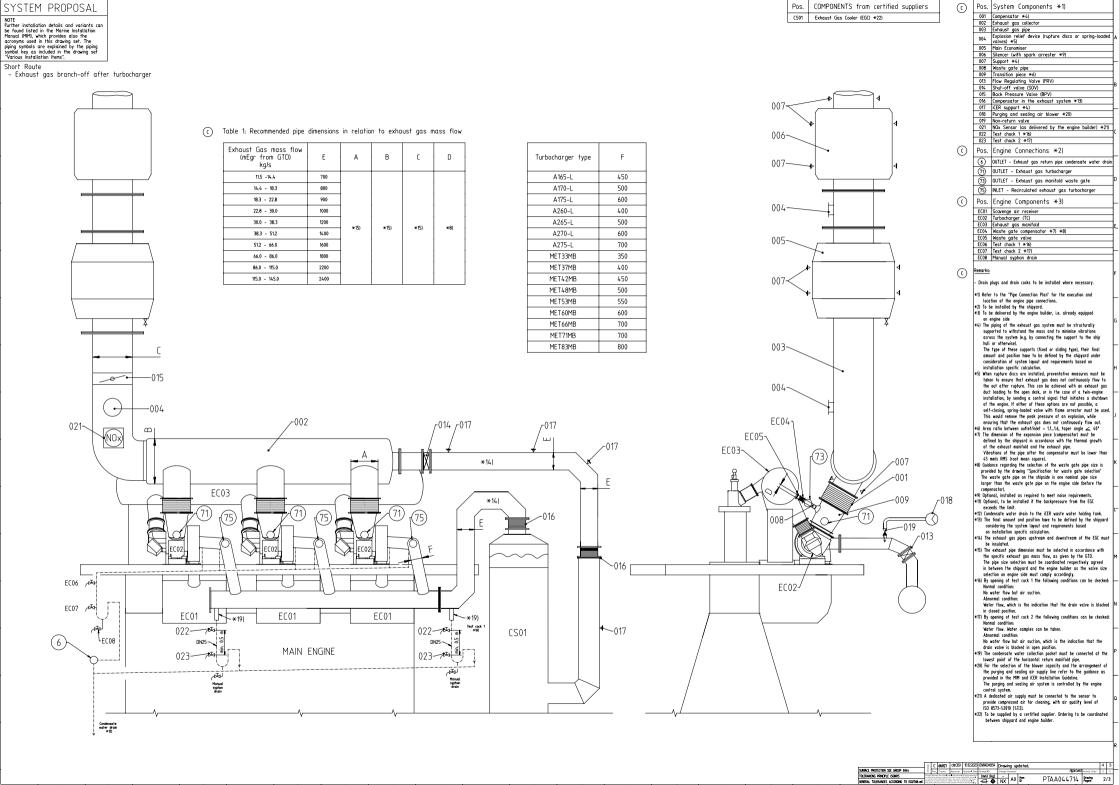
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Specifications which must be met:	
 (73) DUTLET - Exhaust gas manifold waste gate Size and layout of connection flange is provided in the "Pipe Connection Plan" The pipe diameter must be selected according to the guidance as provided on the drawing "Specification for waste gate selection" Waste gate connection pipe to main exhaust gas pipe must be kept as short as possible to avoid swirl and extensive back pressure. (75) INLET - Recirculated exhaust gas turbocharger 	0UTLET - Exhaust gas turbocharger - Exhaust gas temperature and volume flow: according to GTD - If the iCER diesel option is selected a NOx sensor must be installed in the exhaust gas pipe between Back Pressure Valve (BPV) and turbocharger. - The total back pressure of the exhaust gas system must be kept within the following ranges: Diesel Tier II mode in section A and C Design limit: From max. 30 mbar iCER gas Tier III mode in section A and B Design limit: From max. 30 mbar to max. 45 mbar
Exhaust temperature: - Controlled by the EGC - Must be always below the scavenge air temperature Exhaust gas piping: - Piping with cones, bends and pipe connections must be flow optimised and arranged in a way to avoid condensation draining to the turbocharger suction. - The piping between the exhaust gas cooler outlet and turbocharger inlet must be insulated to avoid	Operational limit: max. 55 mbar iCER diesel Tier III mode in section A and B Design limit: Not relevant in layout Operational limit: max. 55 mbar Remark: The available back pressure range provided in this drawing refers to the differential pressure between the pipe connections #71 and #75. Funnel Section C
 condensation of the humid recirculating exhaust gas on the pipe wall. The same insulation standard, as used on the hot side before the cooler, must be applied on the exhaust gas return pipe accordingly. To prevent water droplets in the exhaust gas flow, or water condensate on the pipe wall, from being carried over to the turbocharger, the exhaust gas return pipe must be routed below the level of the turbochargers. Condensate water drains must be arranged at the lowest point of the horizontal return manifold pipe. Different vessel trim conditions must be considered. The exhaust gas return pipe must be purged by air in the counterflow direction through the SOV. 	Section A E/H recirculation (relevant) for CER operating modes)
The purging flow must be the total iCER casing volume, to be exchanged 4.5 times per hour with a maximum back pressure of 80 mbar. 0 0UTLET - Exhaust gas return pipe condensate water drain - Drain to the iCER waste water holding tank	Main Engine 75
	 The exhaust gas pipe must be insulated according to applicable rules, e.g. SOLAS. Pipe dimensions in relation to the exhaust gas mass flow rates are provided by table 1 on page 2. 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 the 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 rolief devices, examined and certified by the maker, with flameless pressure relief (rupture discs or self-closing, spring-loaded valves) must be selected and installed within the exhaust system in accordance with class requirements. The exact position and number of explosion relief devices must be determined by the system designer or the shipyard through calculation. Independently, which type of explosion relief devices is selected, the distance of the explosion relief device to gangways, working areas and system components must be at least 3 m to not endanger personeel and/or to avoided. Supports (fixation points) for the mass of piping and exhaust gas system components 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 of 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 cleaned and treated by the water treatment unit to fulfill the following requirements: A maximum solids content of 150 mg/l and a proper pH value (e.g. above PH 6).
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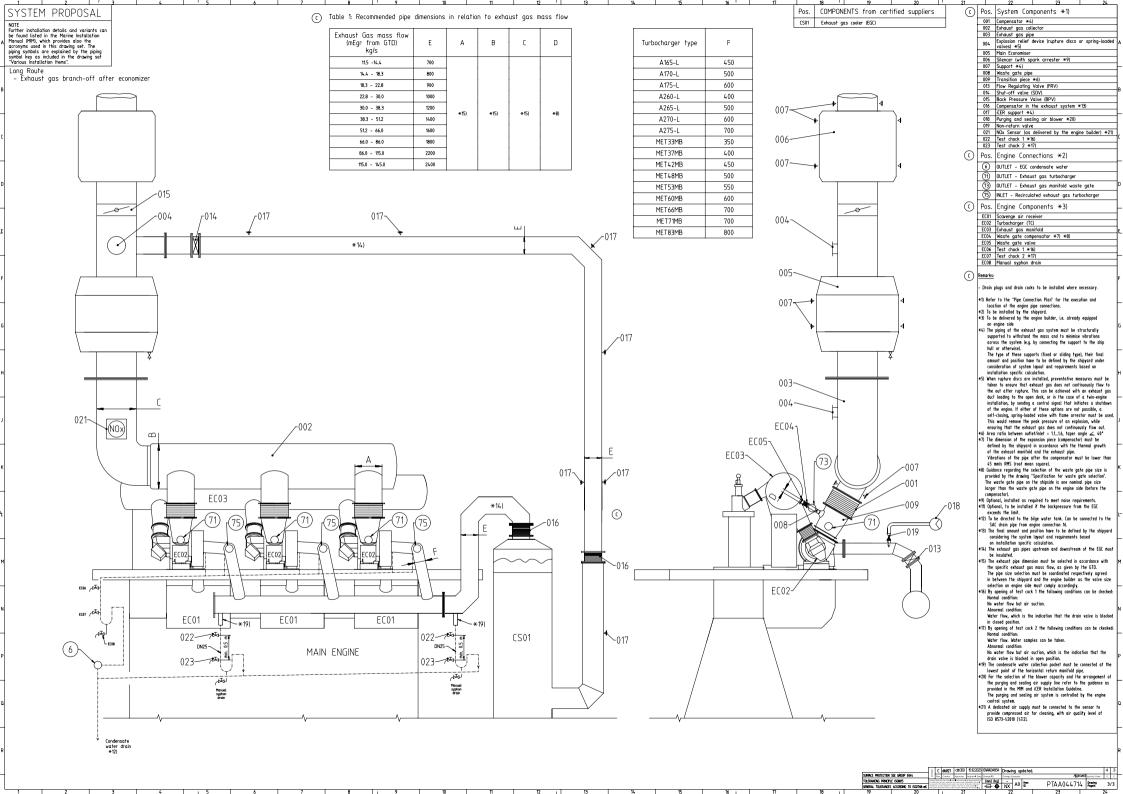


SEQ NO	QTY	Item ID		Item Name				Dimension	Standard-ID	Basic Material			Net Weight
1	1	PTAAC)44714	EXHAUST SY	'STEM		with	three turbocharger					0
2	1	PAAD	327310	SPECIFICATI	ON								0.001
3	1	DAAD	139643	GUIDELINES									
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			ır Gas &				JRBC	CHARGER	S				
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 Size and layout of connection flange is provided in the "Pipe Connection Plan" The pipe diameter must be selected according to the guidance as provided on the drawing "Specification for waste gate selection" Waste gate connection pipe to main exhaust gas pipe must be kept as short as possible to avoid swirl and extensive back pressure. INLET - Recirculated exhaust gas turbocharger INLET - Recirculated exhaust gas turbocharger 	1		7 8 9 10 11 12
	Sper	cifications which must be met:	
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<text></text>			 If the iCER diesel option is selected a NOx sensor must be installed in the exhaust gas pipe between Back Pressure Valve (BPV) and turbocharger.
 L. Bruches downed version by the second version version by the second version ver	- W	aste gate connection pipe to main exhaust gas pipe must be kept as short as possible to avoid swirl and extensive back pressure.	Design limit: From max, 30 mbar to max, 60 mbar
<text><text><text><text></text></text></text></text>	5) INLE	T - Recirculated exhaust gas turbocharger	Design limit: From max. 30 mbar to max. 45 mbar
<text><text><text><text></text></text></text></text>	- Exhc		CER diesel Tier III mode in section A and B
		,	Design limit: Not relevant for layout Operational limit: max. 55 mbar
<text><text></text></text>			the pipe connections #71 and #75.
<text></text>	- Pi in	ping with cones, bends and pipe connections must be flow optimised and arranged a way to avoid condensation draining to the turbocharger suction.	
<text></text>	- Tt	ne piping between the exhaust gas cooler outlet and turbocharger inlet must be insulated to avoid Andensation of the bumid recipculation exhaust ans on the nine wall	relevant for
<text></text>	- TI	he same insulation standard, as used on the hot side before the cooler, must be applied on the exhaust	
<text></text>	- To	p prevent water droplets in the exhaust gas flow, or water condensate on the pipe wall, from being	
<text></text>	CC CC	arried over to the turbocharger, the exhaust gas return pipe must be routed below the level of the turbochargers. ondensate water drains must be arranged at the lowest point of the horizontal return manifold pipe.	
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Indivisible tensions in the piping and forces acting on the turbotharger are not acceptable. - Exhaust gas piping sources to be connected. - Drains of a dequate size and anount must be installed in the exhaust gas piping. - When the noise level on the bridge wing exceeds the class requirement formatily 60 - 70 dd(A) a silencer must be depled. - Uning ICER operation, the recirculated exhaust gas must be colled by ECC circulation water. This water must be depled. - Uning ICER operation, the recirculated exhaust gas must be colled by ECC circulation water. This water must be depled. - Uning ICER operation, the recirculated exhaust gas must be colled by ECC circulation water. This water must be depled. - Uning ICER operation, the recirculated exhaust gas piping. - View the treatment unit to furfill the following requirements. A maximum solids content of 50 mglt and a proper aft value leg, above pri 6). - View tension of the piping and forces acting on the treatment unit to furfill the following requirements. A maximum solids content of 50 mglt and a proper - View tension of the piping and forces acting on the treatment unit to furfill the following requirements. A maximum solids content of 50 mglt and a proper - View tension of the piping and forces acting updated			
- Drains of adequate size and amount must be installed in the exhaust gas piping. - When the noise level on the bridge wing exceeds the close requirement formally 60 - 70 dB(A) a silencer must be capited. - Unterpretent the recirculated exhaust gas must be coded by ECC circulation water. This water must be cleaned and proper phy value le.g. above pH 6.			Inadmissible tensions in the piping and forces acting on the turbocharger are not acceptable.
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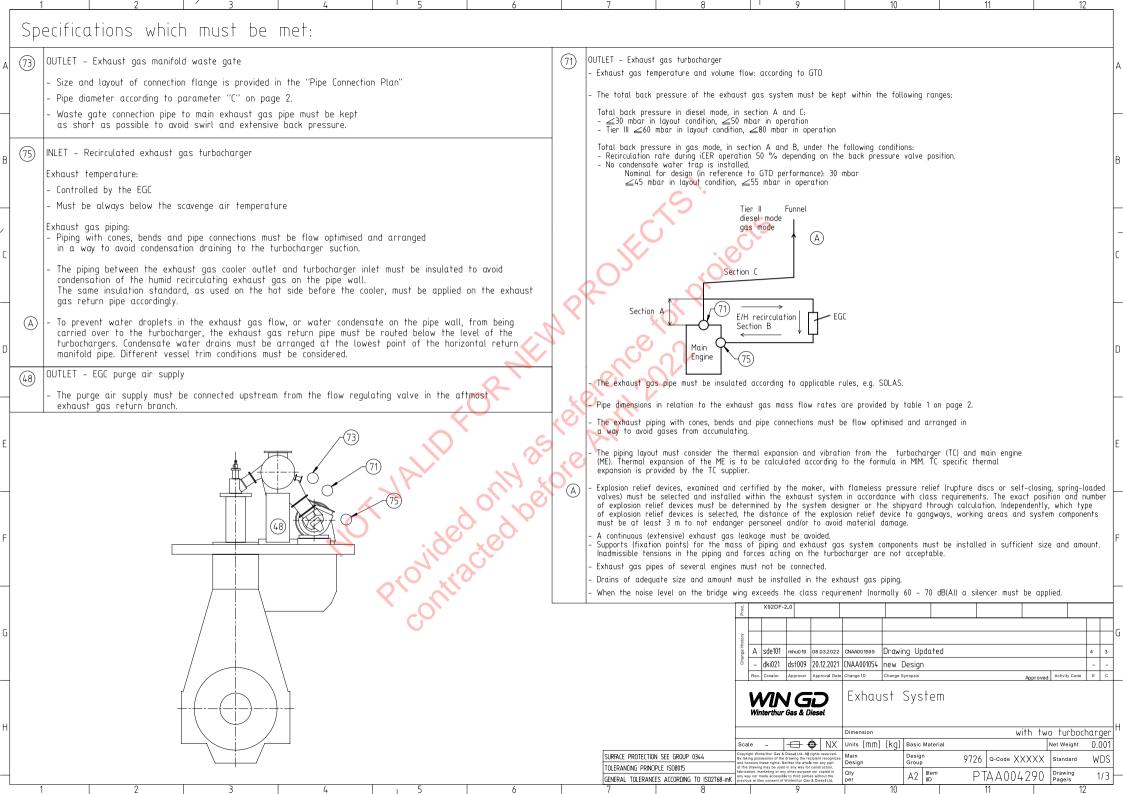
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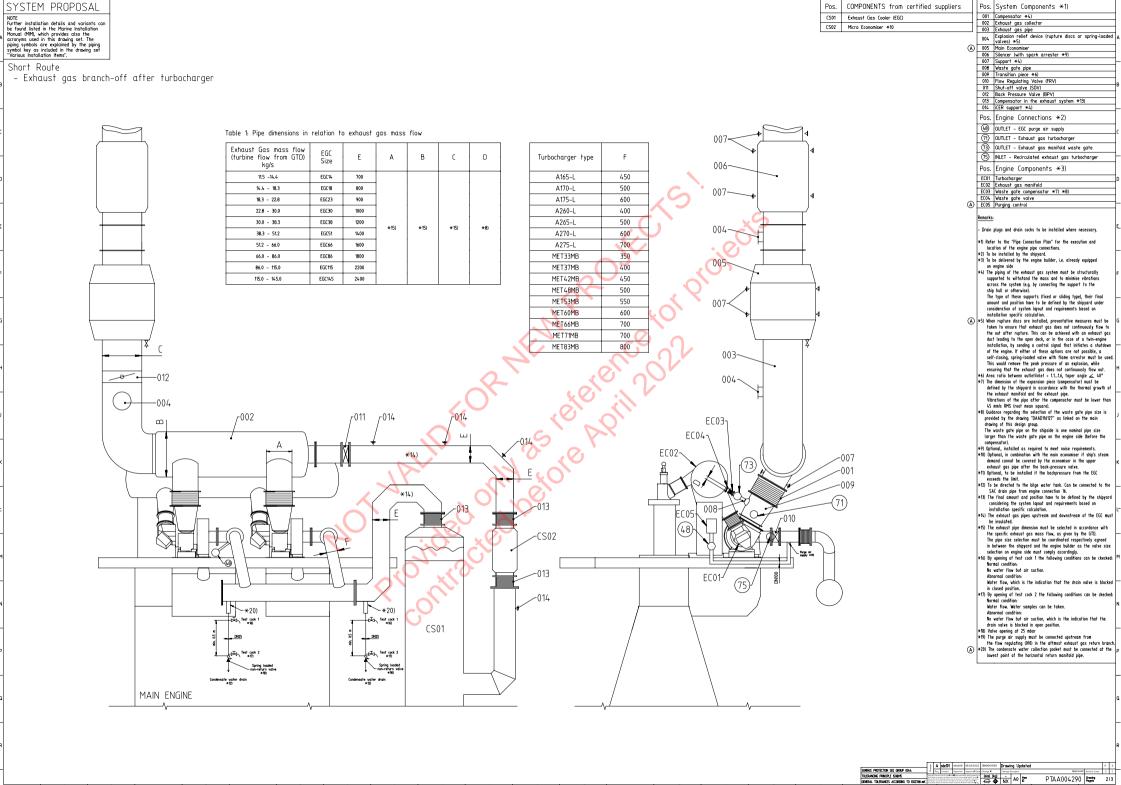
The following pages are provided only as reference for projects which had been contracted before April 2022

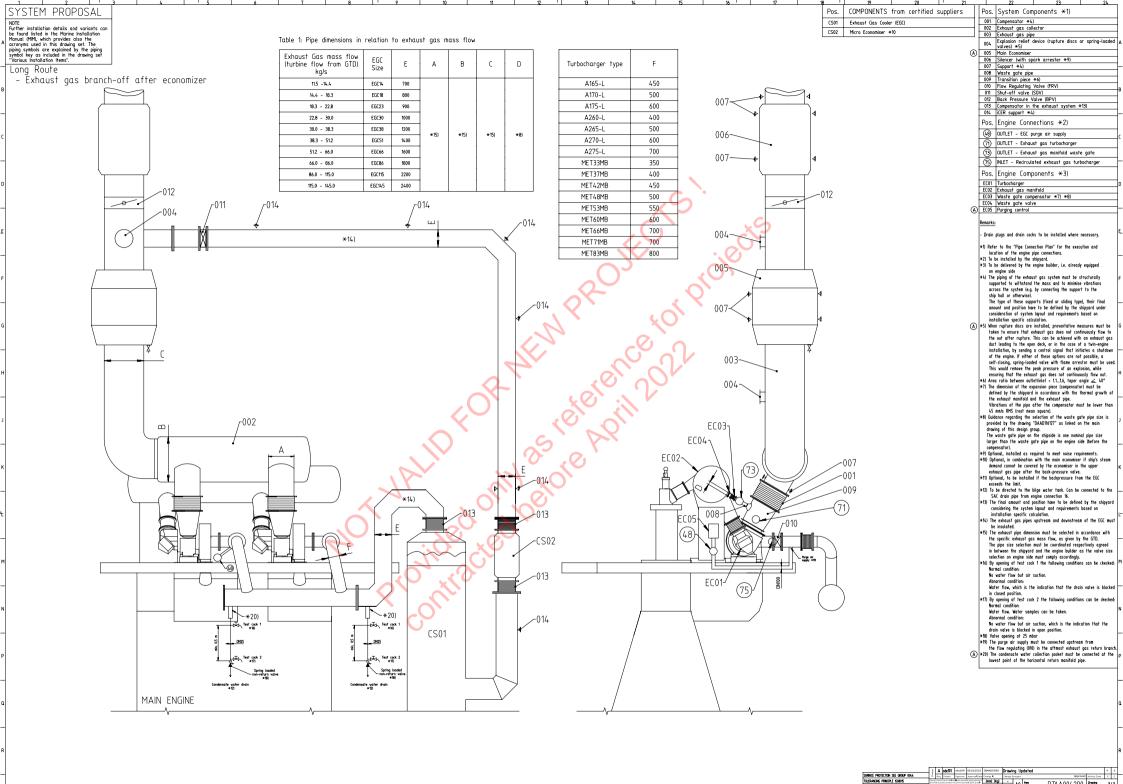
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SEQ NO	QTY	Item ID		Item Name			Dimension	Standard-ID	Basic Material		,	Net Weight
1	1	PTAA0	04290	Exhaust Syste	m	with t	wo turbocharger					0.001
2	1	PAAD3	27310	SPECIFICATI	ON	with t	wo turbocriarger					0.001
<u> </u>				GUIDELINES								
3	1	DAAD1	39643									
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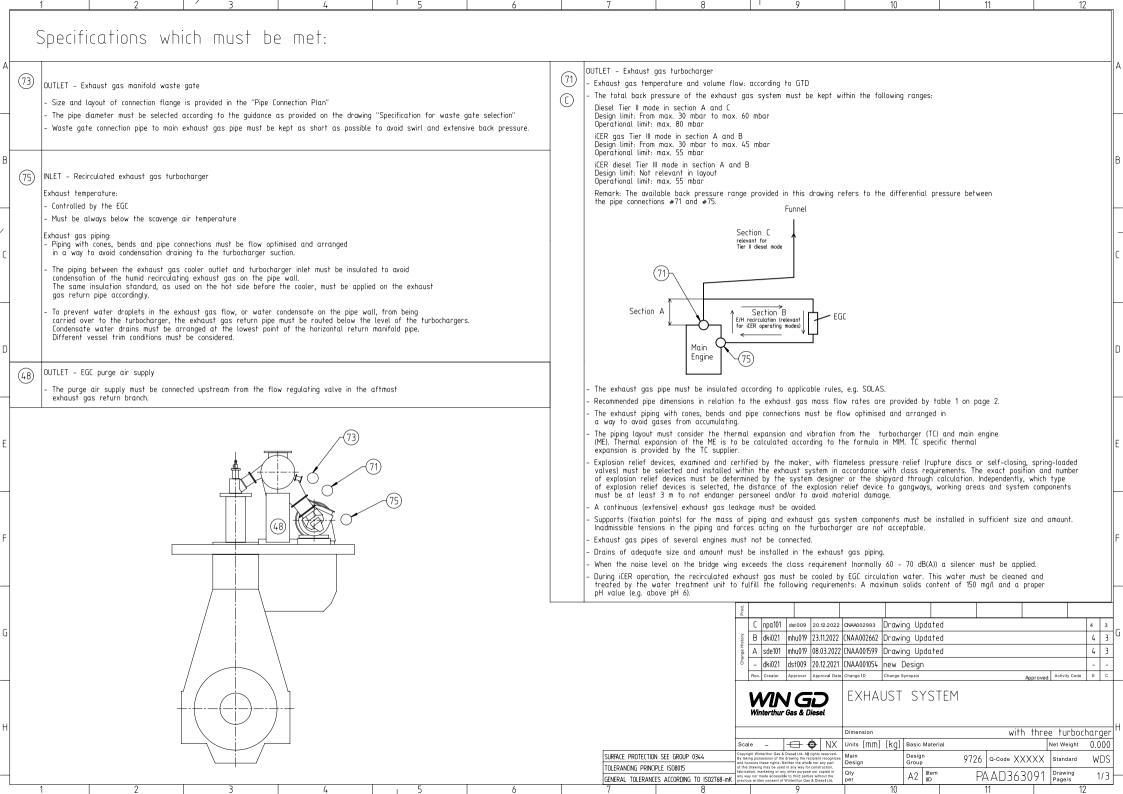






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SEQ NO	QTY	Item ID		Item Name			Dimension	Standard-ID	Basic Material		,	Net Weight
1	1	PAAD3	63091	Exhaust Syste	em	W	ith three turbocharger					0.001
2	1	PAAD3	27310	SPECIFICATI	ON	W						0.001
				GUIDELINES							_	0.001
3	1	DAAD1	39643									
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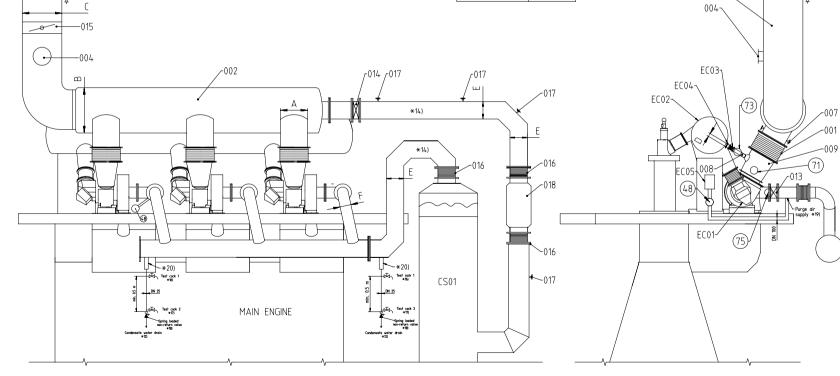


SYSTEM PROPOSAL NOTE Forther installation details and variants can be found listed in the Marine Installation A Manual (MM), which provides also the acromyms used in this drawing set. Their pping symbols are explored by the pping symbol key as included in the drawing set "Various installation items". Short Route - Exhaust gas branch-off after turbocharger

Table 1: Recommended pipe dimensions in relation to exhaust gas mass flow

Exhaust Gas mass flow (turbine flow from GTD) kg/s	EGC Size	E	A	в	C	D
11.5 -14.4	EGC14	700				
14.4 - 18.3	EGC18	800				
18.3 - 22.8	EGC23	900				
22.8 - 30.0	EGC30	1000				
30.0 - 38.3	EGC38	1200	*15)	*15)	*15)	*8)
38.3 - 51.2	EGC51	1400	*0)	*0)	*15)	*8)
51.2 - 66.0	EGC66	1600				
66.0 - 86.0	EGC86	1800				
86.0 - 115.0	EGC115	2200				
115.0 - 145.0	EGC145	2400				

	1
Turbocharger type	F
A165-L	450
A170-L	500
A175-L	600
A260-L	400
A265-L	500
A270-L	600
A275-L	700
MET33MB	350
MET37MB	400
MET42MB	450
MET48MB	500
MET53MB	550
MET60MB	600
MET66MB	700
MET71MB	700
MET83MB	800



T	19 20 COMPONENTS from certifie		Pos.	22 23 24 System Components *1)	1
ł	Exhaust Gas Cooler (EGC)	a suppliers	001	Compensator *4)	
-			002	Exhaust gas collector Exhaust gas pipe	
			004	Explosion relief device (rupture discs or spring-loaded valves) *5)	ľ
			005	Main Economiser Silencer (with spark arrester *9)	
			007	Support +4) Waste gate pipe	ſ
			009	Transition piece *6) Flow Regulating Valve (FRV)	e
			014	Shut-off valve (SOV) Back Pressure Valve (BPV)	ľ
			016	Compensator in the exhaust system *13) iCER support *4)	
			018	Additional Economiser *10)	
_			Pos. (48)	Engine Connections *2) OUTLET - EGC purge air supply	4
_	4		1	OUTLET – Exhaust gas turbocharger	1
	4		Ō	OUTLET – Exhaust gas manifold waste gate	-
			105	INLET - Recirculated exhaust gas turbocharger	
-	.		Pos. EC01	Engine Components *3) Turbocharger	c
			EC02 EC03	Exhaust gas manifold Waste gate compensator *7) *8)	1
	4		EC04	Waste gate valve Engine mounted purging and sealing air blower	ł
	/		Remarks:	panging mounted parging and seating air brower	1
_				plugs and drain cocks to be installed where necessary.	
			*1) Refe	r to the "Pine Connection Plan" for the execution and	
_			*71 To F	tion of the engine pipe connections. e installed by the shippard. e delivered by the engine builder, i.e. already equipped	ľ
			00	engine side	ļ
	\		*4) The	piping of the exhaust gas system must be structurally sorted to withstand the mass and to minimise vibrations	ľ
	4		acro	ors the system (e.g. by connecting the support to the ship or otherwise).	
			ano	type of these supports (fixed or sliding type), their final unt and position have to be defined by the shipyard under	l
	4		con: inst	ideration of system layout and requirements based on allation specific calculation.	
	/		*5) Whe tak	n rupture discs are installed, preventative measures must be en to ensure that exhaust gas does not continuously flow to	l
	x/		duct	out after rupture. This can be achieved with an exhaust gas leading to the open deck, or in the case of a twin-engine	$\left  \right $
	P		of	allation, by sending a control signal that initiates a shutdown the engine. If either of these options are not possible, a	l
_			This	-closing, spring-loaded valve with flame arrestor nust be used. would remove the peak pressure of an explosion, while	ŀ
	•		*6) Arec	uring that the exhaust gas does not continuously flow out. $\alpha$ ratio between outlet/inlet = 1.116, taper angle $\angle$ 40° formation of the expansion size (companyedae) must be	l
			defi	dimension of the expansion piece (compensator) must be ned by the shipyard in accordance with the thermal growth the exhaust manifold and the exhaust pipe.	ŀ
			Vibr	nations of the pipe after the conpensator must be lower than mm/s RHS (root mean square).	l
			*8) Guid	ance regarding the selection of the waste gate pipe size is ded by the drawing "Specification for waste onte selection"	ŀ
			The	waste gate pipe on the shipside is one nominal pipe size r than the waste gate pipe on the engine side (before the	l
			conp	ensator). anal, installed as required to meet noise requirements.	ľ
	/ _007		*10) Opt dem	ional, in combination with the main economiser if ship's steam and cannot be covered by the economiser in the upper	ļ
<u> </u>			exhi *11) Opti	aust gas pipe after the back-pressure valve. onal, to be installed if the backpressure from the EGC	ľ
-	-001		exce +12) To	eeds the limit. be directed to the bilge water tank. Can be connected to the	ŀ
	-009		*13) The	£ drain pipe from engine connection 16. final amount and position have to be defined by the shipyard	l
			on	isidering the system layout and requirements based installation specific calculation.	
1	2° (71) 2013		be	exhaust gas pipes upstream and downstream of the EGC nust insulated. exhaust pipe dimension must be selected in accordance with	l
1			the	specific exhaust gas mass flow, as given by the GTD. pipe size selection must be coordinated respectively agreed	ŀ
4			in b sele	etween the shipyard and the engine builder as the valve size . ction on engine side must comply accordingly.	l
	Purge air		*16) By Norr	opening of test cock 1 the following conditions can be ckecked: nal condition:	ľ
			No Abn	water flow but air suction. ormal condition:	l
			inc	er flow, which is the indication that the drain valve is blocked losed position.	ſ
	( )		Nori	opening of test cock 2 the following conditions can be ckecked: nal condition:	,
	$\bigcirc$		Abn	er flow. Water samples can be taken. ormal condition:	Í
			drai	water flow but air suction, which is the indication that the n valve is blocked in open position.	ŀ
			(*19) The	ve opening at 25 mbar. purge air supply line must be connected upstream from regulation value (ATR) to the FGC exhaust one return nine	I
			*20) The	r regulating valve (013) to the EGC exhaust gas return pipe. e condensate water collection pocket must be connected at the est point of the horizontal return manifold pipe.	1
			Color		l
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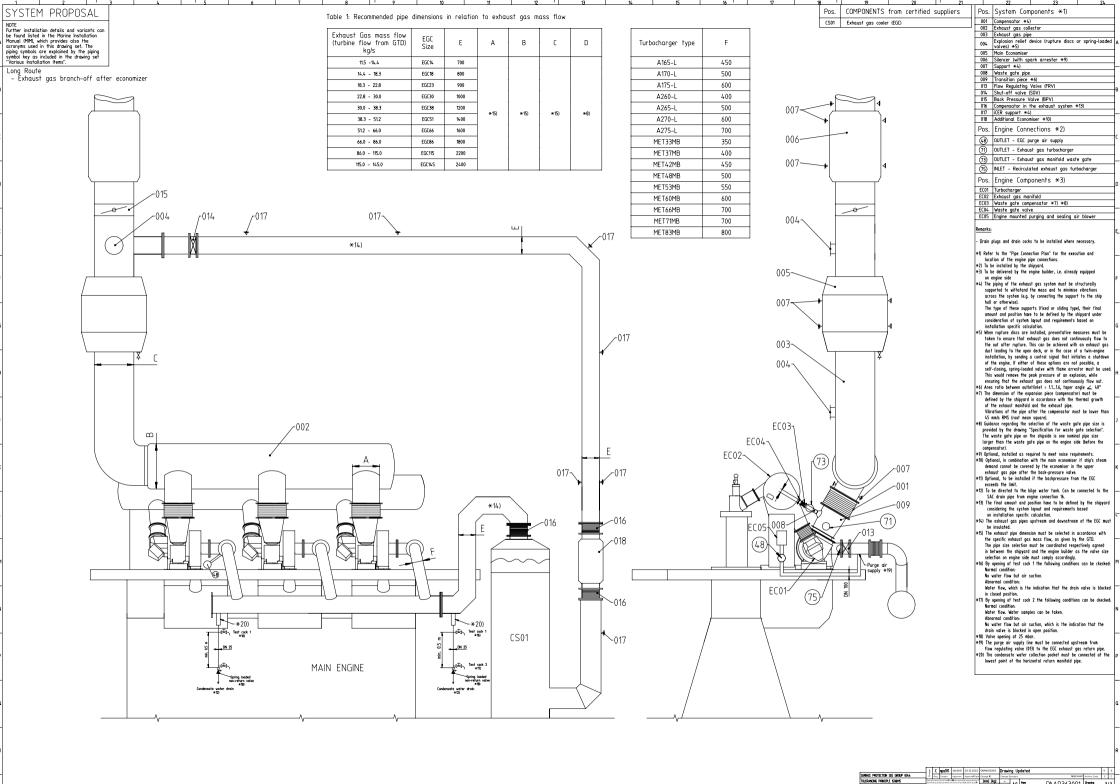
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CS01 Exhaust Gas Cooler (EGC)

Approved Access Core C C C
PAAD363091 Registr 2/3
22 Bec C roath dances 20.12.21 Drawing Updated surface protection see group 0344 Toleranding principle isorots Terror Change Orange Synopole NERAL TOLERANCES ACCORDING TO ISO2768-INK



Inni Bal - A0 Ben PAAD363091 3/3 eneral tolerances according to 1502768-ink



## MIDS – Exhaust System (DG9726)

WinGD X92DF-2.0

## TRACK CHANGES

DATE	SUBJECT	DESCRIPTION
2021-08-31	DRAWING SET	First web upload
2021-12-22	PTAA004290 PAAD363091	System drgs – new revision
2022-03-14	PTAA004290 PAAD363091	System drgs – new revision
2022-12-01	PTAA004290 PAAD363091 PTAA044722	System drgs – new revision New drawing set as replacement of the previous one - added
2022-12-20	PTAA004290 PAAD363091 PTAA044714	System drgs – new revision
2023-03-27	PTAA051371 PTAA044714	System drgs – new revision
2023-12-19	PTAA044714	System drgs – new revision
2024-02-08	PTAA051371B	New revision

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