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SURFACE PROTECTION SEE GROUP 0344

TOLERANCING PRINCIPLE ISO8015

GENERAL TOLERANCES ACCORDING TO ISO2768-mK

Available executions

Execution No.	Material ID	Cylinder No.	Attribute 1: Gas pressure regulation		Attribute 2: Gas supply system	
			iGPR	GVU	NG	NG+VOC
001	PAAD302406	5-8	X		X	
002	PAAD908033	5-8		X	X	

NOTE

The above executions can be configured using the Engine Configurator.

Detailed guidance for the executions is provided within the Marine Installation Manual (MIM). If a specific execution of interest is not shown in the above table, then it may still be under development or not available. For further information or in case of a project-specific request, WinGD must be contacted directly.

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Prod.									
Change History									
	-	sde101	mhu019	10.11.2021	CNAA000934	new Design		-	-
	Rev.	Creator	Approver	Approval Date	Change ID	Change Synopsis	Approved	Activity Code	E C

WIN GD
Winterthur Gas & Diesel

FUEL GAS SYSTEM
MIDS master drawing

separate BOM available

Dimension

Scale	-		NX	Units [mm] [kg]	Basic Material	Net Weight	0.001		
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Qty per	A4	Item ID	PTAA016513		Drawing Page/s	1/1			

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2

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4

SEQ NO	QTY	Item ID	Item Name	Dimension	Standard-ID	Basic Material	Net Weight
001	1	PAAD302404	FUEL GAS SYSTEM				0.001
002	1	PAAD278947	FLUSHING INSTRUCTION PIPING				0.001
003	1	PAAD149646	ENGINE SAFETY CONCEPT DF ENGINE SAFETY CONCEPT				0.001

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Prod.	5,6,7,8 X72DF 5,6,7,8 X72DF-1.1			5,6 X72DF-1.2 5,6,7 X72DF-2.1		5,6 X72DF-2.2		
Change History								
	A	sde101	nm1019	10.11.2021	00000000	Main Design/Drawing Introduced	4	3
	-	sde101	dst009	14.06.2019		-	-	-
	Rev.	Creator	Approver	Approval Date	Change ID	Change Synopsis	Approved	Activity Code

	FUEL GAS SYSTEM
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Bill Of Material				Dimension				
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Main Design		Yes	Design Group	9727	Q-Code	XXXXX	Standard	WDS
Qty per	Engine	A4	Item ID	PAAD302406			BOM Page/s	01/01

SPECIFICATIONS which must be met:

82 OUTLET - Gas monitoring, piston underside
 - Must not be connected to other venting pipes.
 - Gas release to safe area outside of the engine room.
 - At the end of the vent pipe, safety devices such as flame arrestors must be installed according to the respective class specification and requirement.

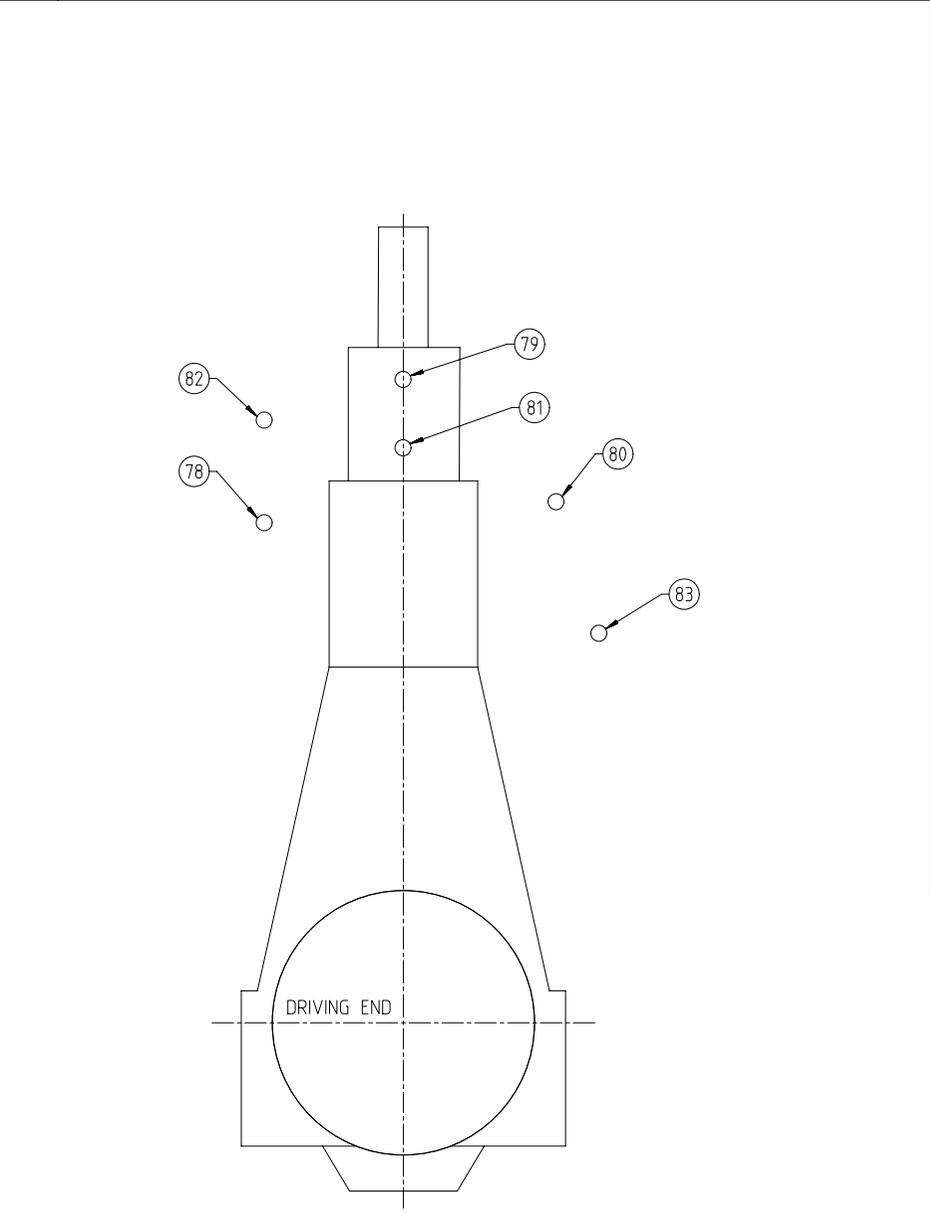
83 INLET - Inert gas filling flowmeter
Pipe connection: Only to be used / connected for maintenance of the flowmeter. To be kept closed / blinded off during normal operation
Inert gas quality: According to the specification in the MIM.

78 INLET - Gas supply
 INNER GAS PIPE
Gas quality: According to the specification in the MIM.
Gas pressure: Design pressure based on GTD requirement for the selected rating and selected minimum LHV plus system pressure drop. Operational variation via the engine control system possible.
Permissible gas pressure fluctuation: ± 0.6 bar (across all frequencies).
Mass flow: According to GTD.
For the gas temperature: 0 - 60°C
 NOTE: Regarding gas temperature vs. ventilation air temperature and methods to avoid / handle condensation in the annular space, refer to the specification for connection 81 and remarks on page 2.
Pipe connection: Inner pipe connected to the gas supply line from gas storage / handling system via flange connection (please refer to the "Pipe Connection Plan").

Inert gas supply: An inert gas supply must be connected piping to the iGPR right after the master gas fuel supply valve to enable purging of the whole system and engine piping
Inert gas quality: According to the specification in the MIM.
Inert gas pressure: Can be selected between 3 and 15 bar(g). Once set-pressure is selected, deviation of ± 10% is allowed, though not below 3 bar.
Inert gas volume engine side: Provided in Table 1 on page 2.

 OUTER PIPE (annular space) - ventilation air outlet
Ventilation air quantity and quality: Refer to the connection 81, "INLET - Ventilation air annular space".
Pipe connection: Outer pipe is connected to the annular space of the supply pipe via flange connection (please refer to the "Pipe Connection Plan").

 Gas detection: A gas detector must be installed in the venting line, at a max. distance of 2 m from the engine inlet, and has to be placed right next to the outer pipe (annular space) connection on the side closest to the engine inlet.
 Interruption of the gas supply: The main gas supply line to each consumer or set of consumers must be equipped with a manually operated stop valve and an automatically operated "master gas valve". The stop valve and the "master gas valve" can be installed either in series or can be executed as a combined manually and automatically operated valve. The valves must be located in the part of the piping, which is situated outside of the machinery space that contains gas.



79 OUTLET - Gas / inert gas release, engine driving end
 - Can be connected to the gas / inert gas release, engine free end (connection 80), but must not be connected to other venting pipes.
 - No additional valves are allowed in the venting pipeline.
 - Gas release to the safe area outside of the engine room.
 - At the end of the vent pipe, safety devices such as flame arrestors must be installed according to the respective class specification and requirement.

80 OUTLET - Gas / inert gas release, engine free end
 - Can be connected to the gas / inert gas release, engine driving end (connection 79), but must not be connected to other venting pipes.
 - No additional valves are allowed in the venting pipeline.
 - Gas release to the safe area outside of the engine room.
 - At the end of the vent pipe, safety devices such as flame arrestors must be installed according to the respective class specification and requirement.

81 INLET - Ventilation air annular space
 - Location and execution according to the "2-S Dual-Fuel Safety Concept" as linked in the MIM.
 - The ventilation air dew point must be lower than the gas temperature. If the ambient air is not sufficiently dry, then dry air must be supplied. Please refer to the remarks and proposals on page 2.
 - Sufficient ventilation air (min. 30 air exchanges per hour) must be sucked by the extraction fan from a safe area into the annular space of the main engine's internal and external piping.
 - For the volume of the ventilation air on the engine side, refer to Table 1 on page 2.

Prod.	X72DF	X72DF-1,1	X72DF-1,2	X72DF-2,1	X72DF-2,2								
Change History	F	sna102	mhu019	24.08.2022	CNA002266	Drawing Updated					4	3	
	E	sde101	mhu019	10.11.2021	CNA000939	Drawing Updated					4	3	
	D	sde101	mhu019	26.04.2021	EAAD095579	Legacy information. See corresponding ChangeNotice					4	3	
	-	sde101	dst009	14.06.2019	-						-	-	
Rev.	Creator	Approver	Approval Date	Change ID	Change Synopsis	Approved					Activity Code	E	C

WIN GD
 Winterthur Gas & Diesel

FUEL GAS SYSTEM
 Gas Pressure Regulation: iGPR

Dimension

Scale - NX

Units [mm] [kg] Basic Material Net Weight 0.001

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TOLERANCING PRINCIPLE ISO8015		Main Design	Design Group 9727	Q-Code XXXXX	Standard WDS
GENERAL TOLERANCES ACCORDING TO ISO2768-mK		Qty per	A2	Item ID PAAD3024.04	Drawing Page/s 1/3

SYSTEM PROPOSAL

NOTE
Further installation details and variants can be found listed in the Marine Installation Manual (MIM), which provides also the acronyms used in this drawing set. The piping symbols are explained by the piping symbol key as included in the drawing set "Various Installation Items".

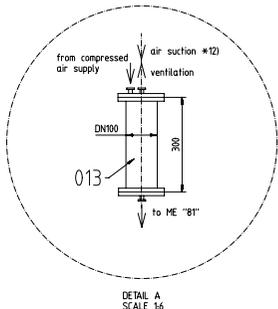
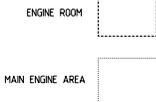
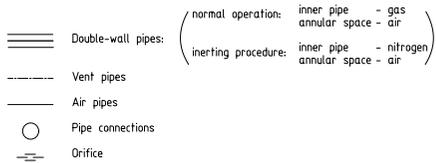


Table 1: Volume of ME internal gas piping

Cylinder	Volume of inner pipe (l)*	Volume of annular space (l)*
5 cyl.	295 l	100 l
6 cyl.	295 l	115 l
7 cyl.	270 l	130 l
8 cyl.	300 l	145 l

* Reference data for inert gas and ventilation air calculation. Ship side piping shall be considered in addition.

Pos.	System Components *2)
001	Gas handling room/cargo machinery room
002	Extraction fan
003	Master gas fuel supply valve
004	Adjustable orifice
005	Pressure regulating valve air supply for pressure test
006	Master gas fuel engine valve *22) *14)
007	Engine room ventilation fan
008	Purging valve
009	Flow indicator
010	Condensate water trap
011	Gas detector engine room *7.2)
012	Bleeding / Vent valve
013	Venting box
014	Shut-off valve, compressed air supply
015	Non-return valve
016	Shut-off valve (double well execution)
018	Intermediate piece
019	Gas detector ship side *7.4)
020	Gas detector engine side *7.1)
021	Manual shut-off valve engine gas supply *20)
022	Manual shut-off valve ancillary gas supply
023	Pressure regulating valve ancillary gas supply
024	Pressure regulating valve annular space air supply
025	Inert gas supply system *17)

Pos.	Engine Components *3)
EC01	Gas filter
EC02	Flowmeter
EC03	Shut-off valve
EC04	Pressure regulating valve
EC05	Bleeding / vent valve
EC06	Shut-off valve gas rail pipe
EC07	Gas detector piston underside
EC08	Vent valve
EC09	Inert gas shut-off valve

Pos.	Engine Connections *1)
78)	INLET - Gas Supply
79)	OUTLET - Gas / Inert gas release, engine driving end
80)	OUTLET - Gas / Inert gas release, engine free end
81)	INLET - Ventilation air annular space
82)	OUTLET - Gas monitoring, piston underside
83)	INLET - Inert gas filling Flowmeter *19)

- Basisks:**
- *1) For the exact position and pipe connection execution, please refer to the "Pipe Connection Plan".
 - *2) To be installed by the shipyard.
 - *3) To be delivered by the engine builder, i.e. already equipped on the engine side.
 - *4) Compressed air supply is required for leakage testing of the gas fuel system pipelines and components. Air is supplied from the starting air system, then air pressure is reduced by the regulating valve (005) to the design gas pressure. The intermediate piece (016) must be removed during normal ME operation (only to be installed for commissioning / maintenance and the connection blinded off).
 - *5) Piping between the gas handling / cargo room and engine is supplied by the shipyard and is connected to the inlet flange on the engine side (outlet of the counter-flange is provided in the "Pipe Connection Plan").
 - *6) Pipe section installed below the main deck in the engine room or cargo machinery room.
 - *7) Double-wall pipe with inner pipe diameter of DN50 and outer pipe diameter of DN60 is recommended. Pipe section installed above the main deck or weather deck.
 - *8) Single-wall pipe with diameter of DN50 is recommended, if the position fulfills the rule requirements of the non-hazardous zone.
 - *9) Inert gas quality: According to the specification in the MIM.
 - *10) Gas detection for annular space with feedback to the engine control system: Mandatory. Must be installed with a distance of max. 2m to engine inlet.
 - *11) Gas detection in the engine room above the ME and the IGR: Required according to the "WärGD 2-5 Dual-Fuel Engine Safety Concept".
 - *12) Gas detection for piston underside (PUS) with feedback to the engine control system: Mandatory.
 - *13) Gas detection for annular space on the ship side (Optional) - to distinguish between system and engine side leaks. If the optional gas detector is not installed, the ventilation line with the extraction fan must be connected to gas detector 82B.
 - *14) Conditional requirement: If the gas temperature is not always higher than the ambient air temperature, condensate may accumulate in the annular space. In this case, condensate traps must be arranged at the low points of the ship side gas piping. If the condensate water trap (LAP) is triggered, the trap must be manually drained. To do this, the inlet valve (marked N.O.) on the drawing must be closed. Then the venting valve and drain valve (marked N.C. on the drawing) is opened. When the trap has been drained, all valves are to be returned to their normal position. For the tank size, it is recommended to consider the volume under tropical conditions, the larger the tank capacity, the lower the drainage requirement. Recommended draining is two times per day.
 - *15) Conditional requirement: No condensate is allowed in the main engine's gas piping. Therefore, if the gas temperature is not higher than the ambient air temperature, a dedicated dry air supply must be arranged either:
 - From the control air supply (must comply with the ISO 8573-1, class 4-4, i.e. dew point $\leq -3^{\circ}\text{C}$).
 - From the air drier (must comply with the ISO 8573-1, class 4-4, i.e. dew point $\leq -3^{\circ}\text{C}$).
 - From the working air supply (as long as the gas temperature is always above 28 °C).
 - *16) Adjustable pressure regulating valve (range 0.5 - 8 barg). Pre-setting procedure: The pressure regulating valve must be adjusted so that the flow indicator 009 shows just a small flow outside when the restriction fan is in operation.
 - *17) The on / off signal of the gas made from the remote control system can be used to open / close the valve.
 - *18) In cases that the compressed air supply is deactivated, an air suction supply must come from a safe area.
 - *19) The extraction fan must have the capacity to exchange the ventilation air at a minimum of 30 times per hour. Please consider the annular volume from the main engine piping (see Table 1) and the additional annular volume from the ship side piping. The suction pressure must cover the pressure drop over the piping on the shipside (as known by the system designer) and the pressure drop over the piping and IGR on the ME side as provided in Table 2 on page 3.
 - *20) To restrict the amount of vented gas, it is recommended that valve 006 closes in a reasonably short time.
 - *21) The purging valve must be located as close as possible and downstream of the master engine valve (006). The purging valve can be connected inside or outside of the engine room. Due to class rules and/or flag state, it may be necessary to install a different arrangement, which contains instead of the "purging valve (007)" alone an extended arrangement (e.g. with a double-block and bleed valve in addition). In that case, the non-return functionality and the remote control function must be integrated accordingly.
 - *22) Inert gas consumption: Calculated according to the formula as provided in the MIM. It must consider the volume of the main engine's internal gas piping, as provided in Table 1.
 - Inert gas pressure (can be selected between 3 and 15 barg). Once set-pressure is selected, deviation of $\pm 10\%$ is allowed, though not below 3 barg).
 - *23) It includes all components for inert gas storage and handling, (e.g. the tank, the pressure regulation, etc.)
 - *24) The annular space of the piping for the other gas consumers must be disconnected from the annular space of the ME gas piping, e.g. separated air suction for the other gas consumers are required.
 - *25) Connection only temporarily used or opened for maintenance of the flowmeter. To be disconnected during normal operation.
 - *26) If the "Manual shut-off valve engine gas supply (021)" is fitted, then it must be installed outside of the machinery space which contains gas consumers and it must be placed as near as possible by the gas heating installation. Alternatively, a combined manually and automatically operated "Master gas fuel engine valve (006)" can be installed and may replace in this regard the separate "Manual shut-off valve engine gas supply (021)". If the "Manual shut-off valve engine gas supply (021)" and the "Master gas fuel engine valve (006)" are not fitted, then a combined manually and automatically operated "Master gas fuel supply valve (003)" must be installed.
 - *27) Air suction must be from a safe area with an adjustable orifice fitted to the air inlet. The orifice is regulated to ensure adequate ventilation for the main engine's gas piping.
 - *28) Conditional requirement - The master gas fuel engine valve must only be installed if there is a branch pipe to the other gas consumers.

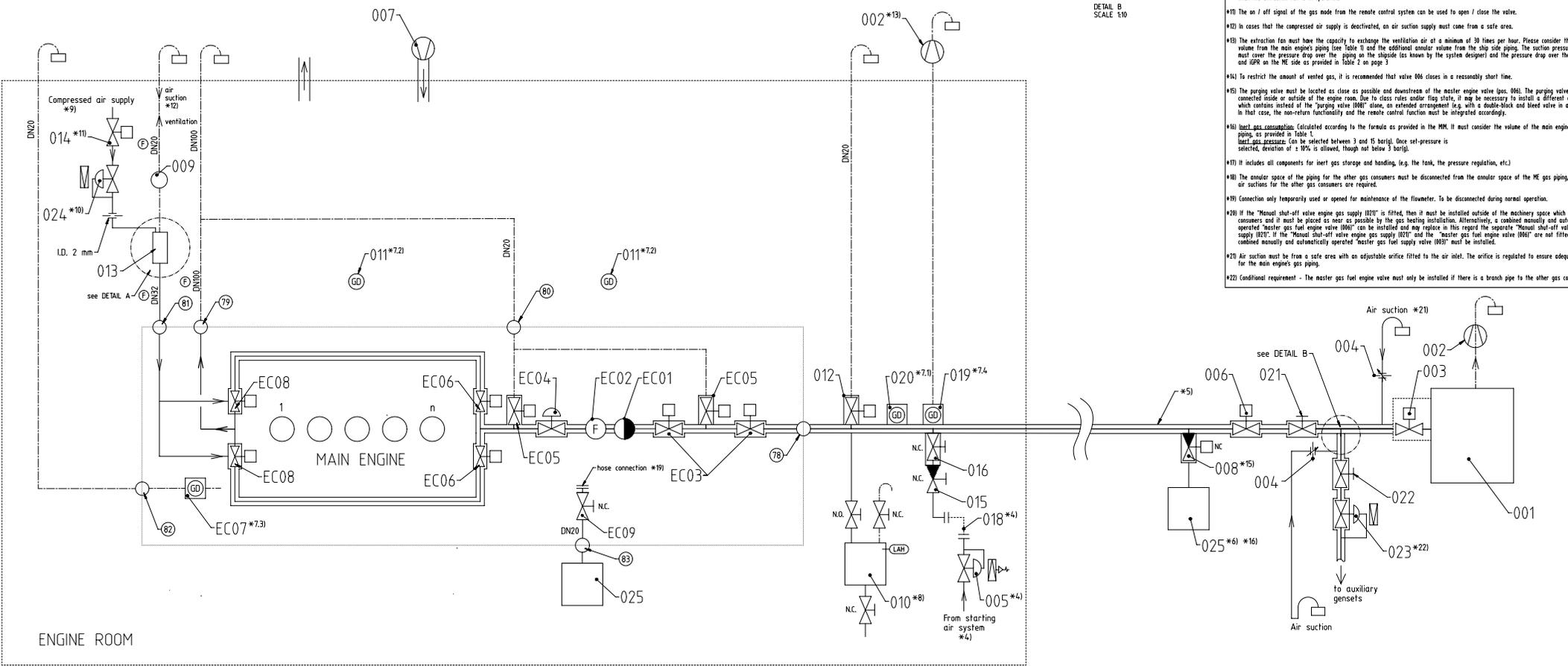
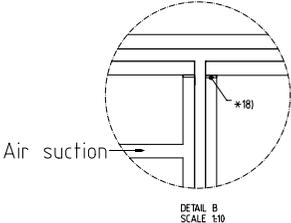
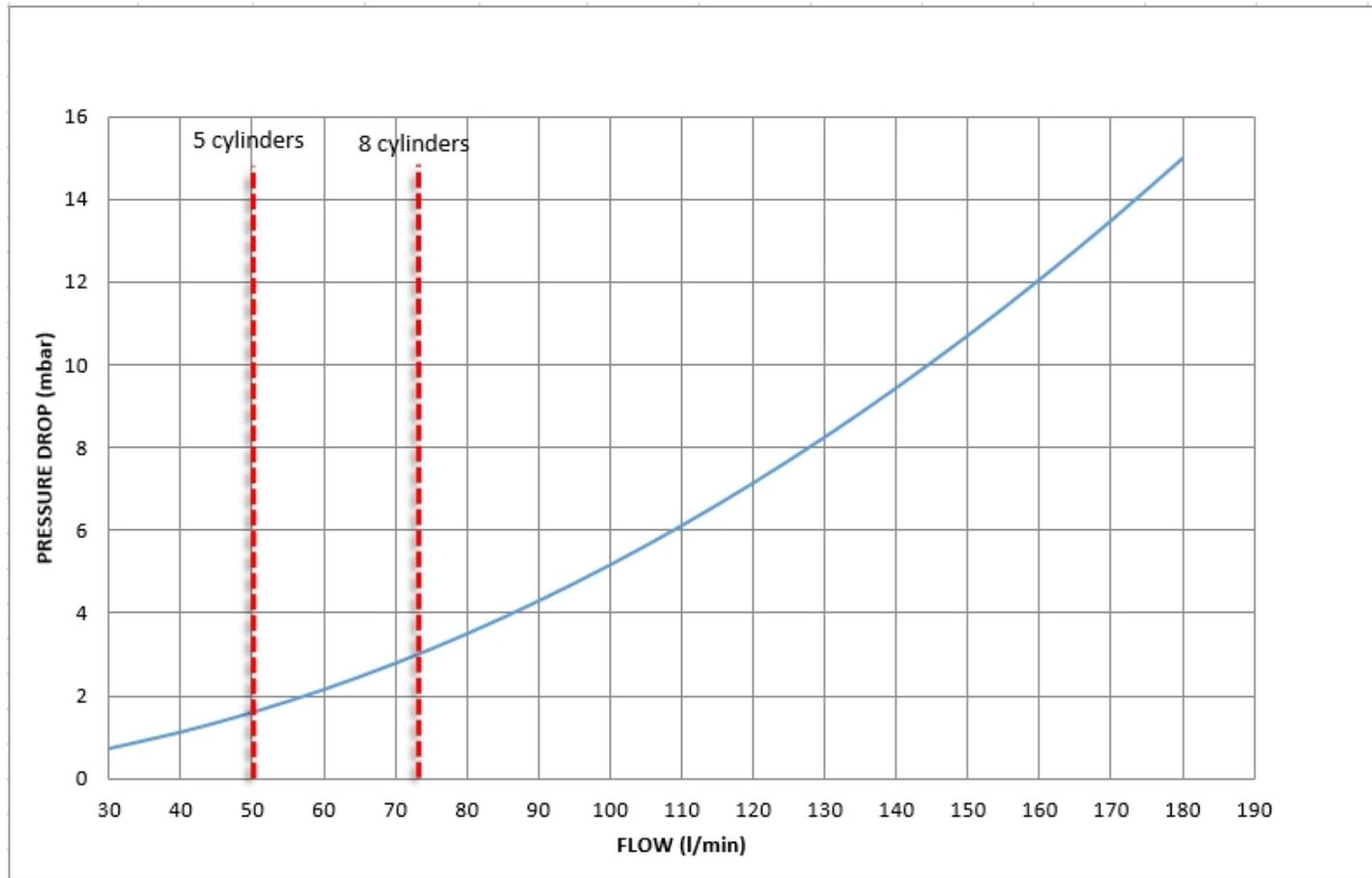


Table 2: Pressure drop over the annular space on engine side (iGPR + piping)



SURFACE PROTECTION SEE GROUP 0344	Change	F	sna102	mhu019	24.08.2022	CNAA002266	Drawing Updated			4	3	
	Rev.	Creator	Approver	Approval Date	Change ID	Change Synopsis			Approved	Activity Code	E	C
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GENERAL TOLERANCES ACCORDING TO ISO2768-mK								NX				

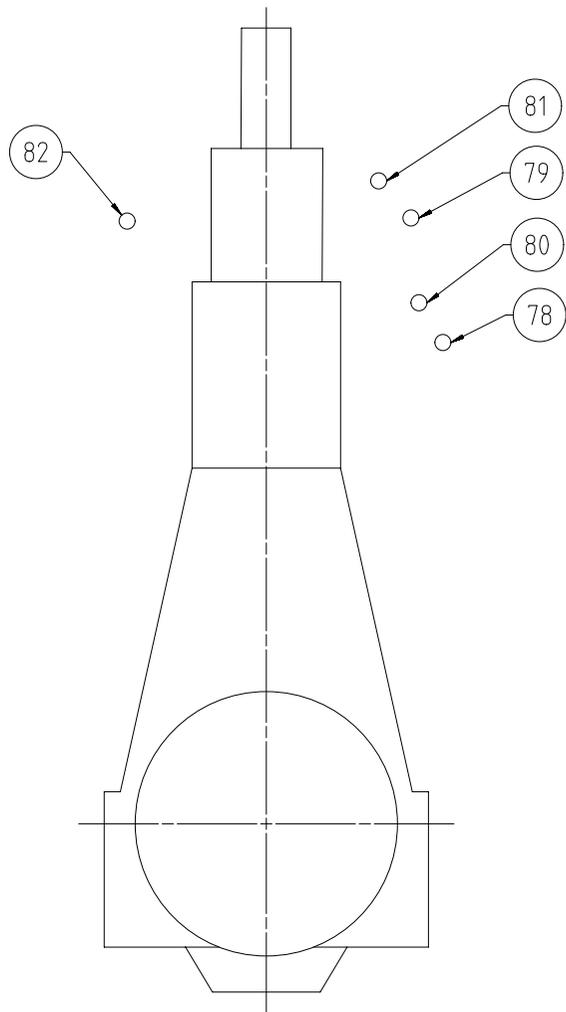
SEQ NO	QTY	Item ID	Item Name	Dimension	Standard-ID	Basic Material	Net Weight
001	1	PAAD194779	FUEL GAS SYSTEM				0.001
002	1	PAAD149646	ENGINE SAFETY CONCEPT DF ENGINE SAFETY CONCEPT				0.001
003	1	PAAD278947	FLUSHING INSTRUCTION PIPING				0.001

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Prod.	5,6,7,8 X72DF 5,6,7,8 X72DF-1.1		5,6 X72DF-1.2 5,6,7 X72DF-2.1		5,6 X72DF-2.2			
Change History	C	sde101	mhu019	10.11.2021	EAAD093769	Main Design/Drawing Introduced	4	3
	B	sde101	dst009	14.08.2020	EAAD093769	Legacy information. See corresponding ChangeNotice	4	3
	A	sde101	mhu019	01.10.2018	EAAD089573	Legacy information. See corresponding ChangeNotice	4	-
	-	dki021	abr030	19.06.2015		-	-	-
	Rev.	Creator	Approver	Approval Date	Change ID	Change Synopsis	Approved	Activity Code

	<h2>FUEL GAS SYSTEM</h2> <h3>with GVU</h3>
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Bill Of Material		Dimension						
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	Main Design	Yes	Design Group	9727	Q-Code	XXXXX	Standard	WDS
	Qty per	Engine	A4	Item ID	PAAD908033		BOM Page/s	01/01



SPECIFICATIONS requirements for ENGINE connections

78	<p>INLET - Gas supply</p> <p>INNER GAS PIPE</p> <p><u>Gas quality:</u> According to the specification in the MIM.</p> <p><u>Gas pressure:</u> Controlled by GVU, load depended.</p> <p><u>Mass flow:</u> According to GTD.</p> <p><u>For the gas temperature:</u> 0 - 60°C</p> <p>NOTE: Regarding gas temperature vs. ventilation air temperature and methods to avoid / handle condensation in the annular space, refer to the specification for connection 81 and remarks on page 3.</p> <p><u>Pipe connection:</u> Inner pipe connected to the gas supply line from GVU via flange connection (please refer to the "Pipe Connection Plan").</p> <p>OUTER PIPE (annular space) - ventilation air outlet</p> <p><u>Ventilation air quantity and quality:</u> Refer to the connection 81, "INLET - Ventilation air annular space".</p> <p><u>Pipe connection:</u> Outer pipe is connected to the annular space of the supply pipe via flange connection (please refer to the "Pipe Connection Plan").</p> <p>Gas detection: A gas detector must be installed in the double wall pipe with a distance of max. 2 m to the engine inlet connection.</p>
79	<p>OUTLET - Gas / inert gas release, engine driving end</p> <ul style="list-style-type: none"> - Can be connected to the gas / inert gas release, engine free end (connection 80), but must not be connected to other venting pipes. - No additional valves are allowed in the venting pipeline. - Gas release to the safe area outside of the engine room. - At the end of the vent pipe, safety devices such as flame arrestors must be installed according to the respective class specification and requirement.
80	<p>OUTLET - Gas / inert gas release, engine free end</p> <ul style="list-style-type: none"> - Can be connected to the gas / inert gas release, engine driving end (connection 79), but must not be connected to other venting pipes. - No additional valves are allowed in the venting pipeline. - Gas release to the safe area outside of the engine room. - At the end of the vent pipe, safety devices such as flame arrestors must be installed according to the respective class specification and requirement.
81	<p>INLET - Ventilation air annular space</p> <ul style="list-style-type: none"> - Location and execution according to the "2-S Dual-Fuel Safety Concept" as linked in the MIM. - The ventilation air dew point must be lower than the gas temperature. If the ambient air is not sufficiently dry, then dry air must be supplied. Please refer to the remarks and proposals on page 3. - Sufficient ventilation air (min. 30 air exchanges per hour) must be sucked by the extraction fan from a safe area into the annular space of the main engine's internal and external piping. - For the volume of the ventilation air on the engine side: Refer to Table 2 on page 3. - For the volume of the ventilation air on the GVU side: Refer to Table 1 on page 2.
82	<p>OUTLET - Gas monitoring, piston underside</p> <ul style="list-style-type: none"> - Must not be connected to other venting pipes. - Gas release to safe area outside of the engine room - At the end of the vent pipe, safety devices such as flame arrestors must be installed according to the respective class specification and requirement.

Prod.	X72DF	X72DF-1.2	X72DF-2.2							
	X72DF-1.1	X72DF-2.1								
Change History	G	sng102	mhu019	24.08.2022	CNA002266	Drawing Updated			4	3
	F	sde101	mhu019	10.11.2021	CNA000939	Drawing Updated			4	3
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	-	wwa008	abr030	19.06.2015					-	-
Rev.	Creator	Approver	Approval Date	Change ID	Change Synopsis	Approved	Activity Code	E	C	

WIN GD
Winterthur Gas & Diesel

FUEL GAS SYSTEM
with GVU

Dimension

Scale - NX Units [mm] [kg] Basic Material Net Weight 0.001

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TOLERANCING PRINCIPLE ISO8015		Main Design Group	9727
GENERAL TOLERANCES ACCORDING TO ISO2768-mK		Q-Code	XXXXX
Qty per	A2	Item ID	PAAD194779
		Standard	WDS
		Drawing Pages	1/4

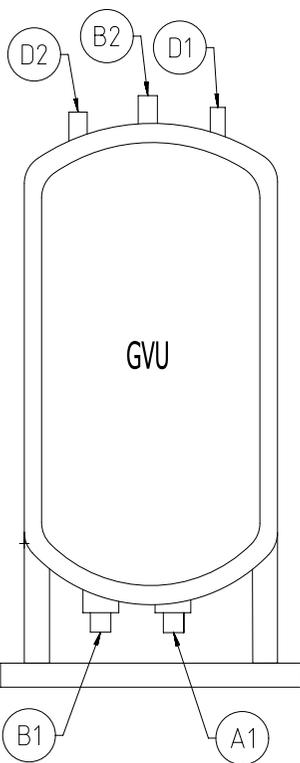
SPECIFICATIONS for GUV connections

D1	<p>OUTLET - Gas / Inert gas release</p> <p><u>Inerting / gas venting procedure:</u> The following areas are vented with air, and in the following order: 1) The ventilation air is sucked from a safe area 2) The annular space of the piping between the air suction connection and the GUV inlet (connection A1) is vented 3) The GUV enclosure or room is vented 4) The air is released via the GUV air ventilation outlet (connection D2) <u>Pipe connection:</u> Connected to a venting line for Gas / inert gas release outside of the engine room.</p>
D2	<p>OUTLET - Ventilation air annular space</p> <p><u>Ventilation procedure:</u> Ventilation air from a safe area - The annular space of the piping between the air suction connection and GUV inlet (connection A1) - the GUV enclosure / room - air release via GUV air ventilation outlet (connection D2). <u>Pipe connection:</u> Connected to a ventilation line with an extraction fan to suck the ventilation air and to release it outside of the engine room. The ventilation fan suction capacity must be sufficient to ensure 30 air exchanges per hour. The ventilation line must be equipped with a gas detector.</p>

A1	<p>INLET - Gas / ventilation air to the GUV</p> <p>INNER GAS PIPE <u>Gas quality:</u> According to the specification in the MIM. <u>Gas pressure:</u> The design pressure is based on the GTD output, which is determined by the selected rating, the minimum LHV, and the system pressure drop. Operational variation via the engine control system is possible. <u>Permissible gas pressure fluctuation:</u> ± 0.6 bar(g) (across all frequencies). <u>Mass flow:</u> According to the GTD. <u>Gas temperature:</u> Aligned with the specification on page 1. <u>Pipe connection:</u> Inner pipe is connected to the gas supply line from gas storage / handling system via flange connection (please refer to the "Pipe Connection Plan").</p> <p>OUTER PIPE (annular space) - ventilation air inlet - Location and execution according to the "2-S Dual-Fuel Safety Concept" as linked in the MIM. - The ventilation air dew point must be lower than the gas temperature. - Sufficient ventilation air (min. requirement of 30 air exchanges per hour) must be sucked by the extraction fan from a safe area into the annular space of the main engine's internal and external piping. <u>Pipe connection:</u> The outer pipe is connected to the annular space of the supply pipe via the flange or the welding connection.</p>
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B1	<p>OUTLET - Gas / ventilation air to the engine</p> <p>INNER GAS PIPE <u>Gas pressure:</u> Adjusted by the GUV gas pressure regulating valve according to engine demand. <u>Pipe connection:</u> Inner pipe is connected to the gas supply line either via a welding or a flange connection.</p> <p>OUTER PIPE (annular space) <u>Pipe connection:</u> Outer pipe is connected to the annular space of the gas supply line either via a welding or a flange connection. The connection pipe to the engine must be kept as short as possible and never longer than 30 m.</p>
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B2	<p>INLET - Inert gas</p> <p><u>Inerting procedure:</u> The following areas are vented with inert gas, and in the following order: 1) The GUV inert gas inlet (connection B2) and the GUV inert gas outlet (connection B1) 3) The piping between the GUV outlet (connection B1) and the gas / inert gas release on the engine. <u>Inert gas quality:</u> According to the specification in the MIM. <u>Inert gas pressure:</u> Can be selected between 3 - 14 bar(g). Once the set-pressure is selected, deviation of ± 10% is allowed. <u>Inert gas consumption:</u> According to guidance in the MIM. <u>Pipe connection:</u> Connected to the inert gas supply system.</p>
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Cylinder Number	GUV Type	GUV INNER PIPE VOLUME	GUV ENCLOSURE VOLUME
5 cylinder	DN100	57.8 l	2270 l
6 cylinder	DN100	57.8 l	2270 l
7 cylinder	DN100	57.8 l	2270 l
8 cylinder	DN100	57.8 l	2270 l

Table 1: GUV-ED VOLUME (values to be used for calculating inerting gas consumption and ventilation air flow.)

Schematic outline view of the the GUV-ED type. For detailed dimensions of the GUV please refer to the GUV supplier layout drawing.

Other designs are possible, e.g. GUV-OD type.

SYSTEM PROPOSAL

NOTE
Further installation details and variants can be found listed in the Marine Installation Manual (MIM), which provides also the acronyms used in this drawing set. The piping symbols are explained by the piping symbol key as included in the drawing set "Various Installation Items".

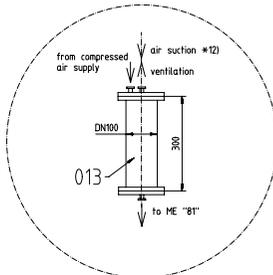
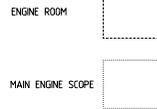
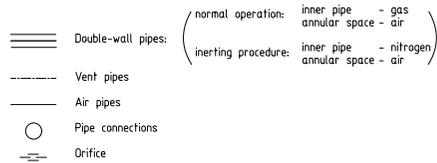


Table 2: Volume of ME internal gas piping

Cylinder	Volume of inner pipe (l)*	Volume of annular space (l)*
5 cyl.	199 l	95 l
6 cyl.	220 l	105 l
7 cyl.	250 l	120 l
8 cyl.	285 l	135 l

* Reference data for inert gas and ventilation air calculation. Ship side piping shall be considered in addition.

Pos.	System Components *2)
001	Gas handling room / cargo machinery room
002	Extraction fan
003	Master gas fuel supply valve
004	Adjustable orifice
005	Pressure regulating valve
006	Master gas fuel engine valve *20) *14)
007	Engine room ventilation fan
008	Purging valve
009	Flow indicator
010	Condensate water trap
011	Gas detector
013	Venting box
014	Shut-off valve, compressed air supply
015	Non-return valve
016	Shut-off valve (double well execution)
018	Intermediate piece
019	GVU (e.g. Wärtsilä enclosed type (GVU-ED) in vertical execution)
020	GVU extraction fan
021	Inert gas supply system *17)

Pos.	Engine Components *3)
EC01	Vent / Purging Valve
EC02	Shut-off valve gas rail pipe
EC03	Vent valve
EC04	Gas detector piston underside

Pos.	Engine Connections**)
78)	INLET - Gas Supply
79)	OUTLET - Gas / Inert gas release, engine driving end
80)	OUTLET - Gas / Inert gas release, engine free end
81)	INLET - Ventilation air annular space
82)	OUTLET - Gas monitoring, piston underside

Remarks:

- #1) For the exact position and pipe connection execution, please refer to the "Pipe Connection Plan".
- #2) To be installed by the shipyard.
- #3) To be delivered by the engine builder, i.e. already equipped on the engine side.
- #4) Compressed air supply is required for leakage testing of the gas fuel system pipelines and components. Air is supplied from the starting air system, then air pressure is reduced by the regulating valve (005) to the design gas pressure. The intermediate piece (008) must be removed during normal ME operation (only to be installed for commissioning / maintenance) and the connection bleated off.
- #5) Piping between the gas handling / cargo room and engine is supplied by the shipyard and is connected to the inlet flange on the engine side (layout of the counter-flange is provided in the "Pipe Connection Plan"). Pipe section installed below the main deck in the engine room or cargo machinery room. Double-wall pipe with inner pipe diameter of DN50 and outer pipe diameter of DN80 is recommended. Pipe section installed above the main deck or weather deck. Single-wall pipe with diameter of DN50 is recommended, if the position fulfils the rule requirements of the non-hazard zone.
- #6) Inert gas consumption is calculated according to the guidance in the MIM.
- #7) Gas detection for annular space with feedback to the engine control system: Mandatory.
- #7.1) Gas detection in the engine room above the ME and the GVU. Required according to class rules.
- #7.3) Gas detection for piston underside (PUS) with feedback to the engine control system: Mandatory.
- #7.4) Gas detection for annular space, on system side: Mandatory, to be installed with a distance of max. 2 m to engine inlet.
- #8) Conditional requirement: If the gas temperature is not always higher than the ambient air temperature, condensate may accumulate in the annular space. In this case, condensate traps must be arranged at the low points of the ship side gas piping. If the condensate water trap LAH is triggered, the trap must be manually drained. To do this, the inlet valve (marked N.O. on the drawing) must be closed. Then the venting valve and drain valve (marked N.C. on the drawing) is opened. When the trap has been drained, all valves are to be returned to their normal position. For the tank size, it is recommended to consider the volume under tropical conditions; the larger the tank capacity, the lower the drainage requirement. Recommended draining is two times per day.
- #9) Conditional requirement: No condensate is allowed in the main engine's gas piping. Therefore, if the gas temperature is not higher than the ambient air temperature, a dedicated dry air supply must be arranged either:
 - From the control air supply (must comply with the ISO 8573-1, class x-4-y, i.e. dew point ≤ 3 °C)
 - From the air dryer (must comply with the ISO 8573-1, class x-4-y, i.e. dew point ≤ 3 °C)
 - From the working air supply (as long as the gas temperature is always above 20 °C).
- #10) Adjustable pressure regulating valve (range 0.5 - 8 barg). Pre-setting procedure: The pressure regulating valve must be adjusted so that the flow indicator 009 shows just a small flow outside when the extraction fan is in operation.
- #11) The on / off signal of the gas made from the remote control system can be used to open / close the valve.
- #12) In cases that the compressed air supply is deactivated, an air suction supply must come from a safe area.
- #13) The extraction fan must have the capacity to exchange the ventilation air at a minimum of 30 times per hour. Please consider the annular space volume from the main engine's piping (see Table 2) and the annular space volume of the ship side piping and the annular space volume of the GVU (according to Table 1 on page 2). The suction pressure must cover the pressure drop over the GVU (as provided by the GVU supplier), over the piping on the shipside (as known by the system designer) and the pressure drop over the piping on the ME side as provided in Table 3 on page 4.
- #14) To restrict the amount of vented gas, it is recommended that valve 006 closes in a reasonably short time.
- #15) Optional inert gas inlet connection. Only to be installed if needed for manual purging. If installed, the purging valve must be located as close as possible and downstream of the master engine valve (006). The purging valve can be connected inside or outside of the engine room. Due to class rules and/or flag state, it may be necessary to install a different arrangement, which contains instead of the "purging valve (008)" alone, an extended arrangement (e.g. with a double-block and bleed valve in addition). In that case, the non-return functionality and the remote control function must be integrated accordingly.
- #17) It includes all components for inert gas storage and handling, (e.g. the tank, the pressure regulation, etc.)
- #18) The annular space of the piping for the other gas consumers must be disconnected from the annular space of the ME gas piping, e.g. separated air suction for the other gas consumers are required.
- #19) Air suction must be from a safe area with an adjustable orifice fitted to the air inlet. The orifice is regulated to ensure adequate ventilation for the main engine's gas piping.
- #20) Conditional requirement - The master gas fuel engine valve must only be installed if there is a branch pipe to the other gas consumers.

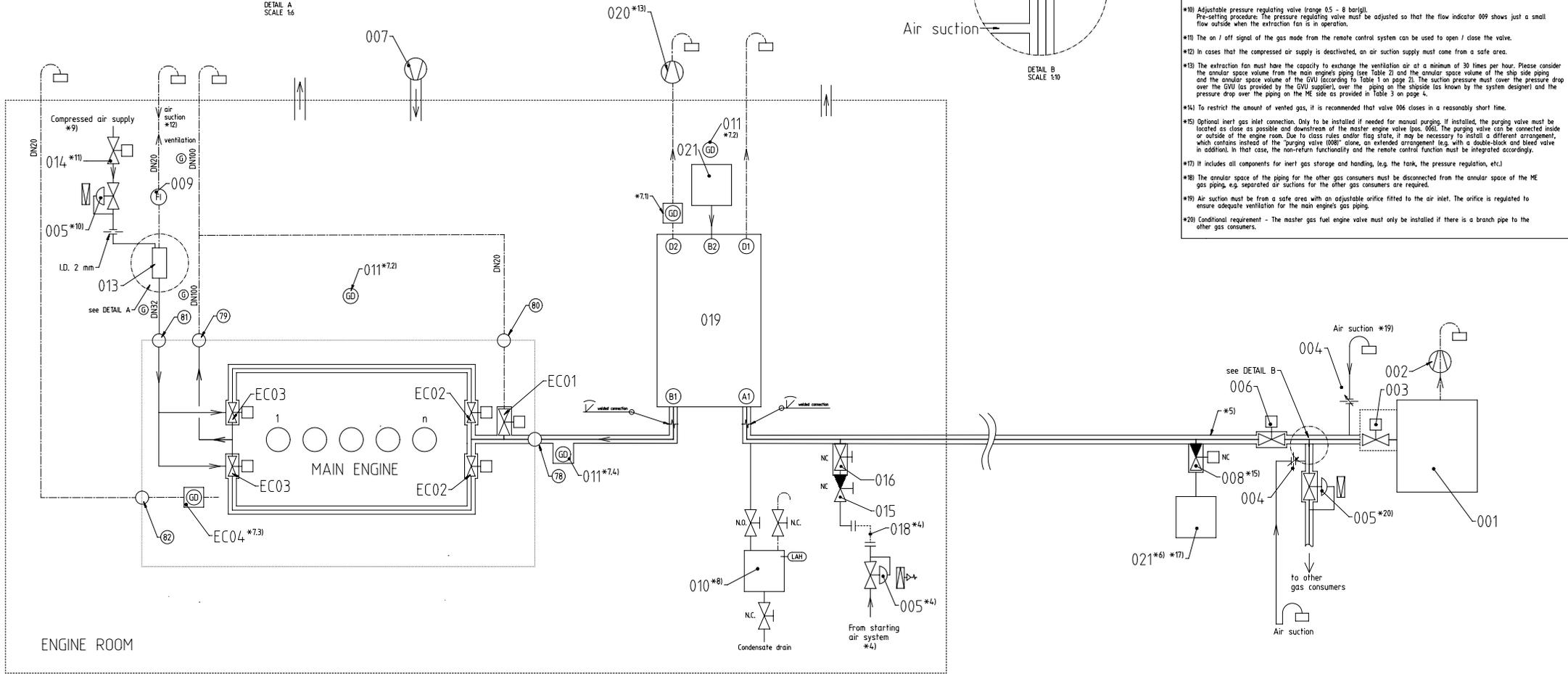
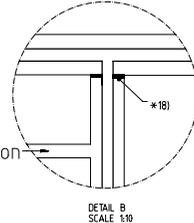
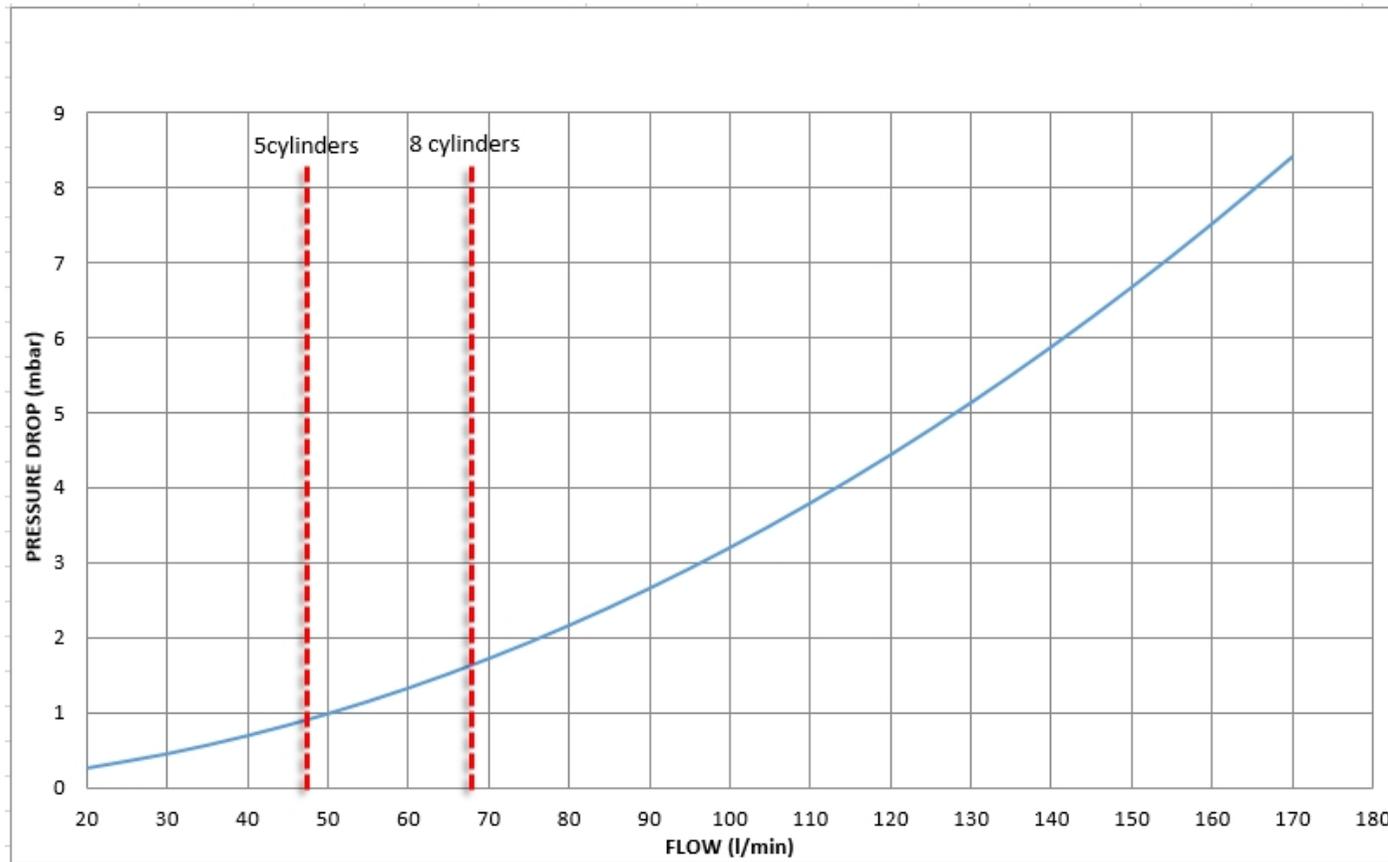


Table 3: Pressure drop over the annular space on engine side



SURFACE PROTECTION SEE GROUP 0344	Change	G	sna102	mhu019	24.08.2022	CNAA002266	Drawing Updated			4	3	
	Rev.	Creator	Approver	Approval Date	Change ID	Change Synopsis			Approved	Activity Code	E	C
TOLERANCING PRINCIPLE ISO8015	Copyright Wintertur Gas & Diesel Ltd. All rights reserved. By taking possession of the drawing the recipient recognizes and honours these rights. Neither the whole nor any part of this drawing may be used in any way for construction, fabrication, marketing or any other purpose nor copied in any way nor made accessible to third parties without the previous written consent of Wintertur Gas & Diesel Ltd.					[mm] [kg]	-	A4	Item ID	PAAD194779	Drawing Page/s	4 / 4
GENERAL TOLERANCES ACCORDING TO ISO2768-mK								NX				

MIDS WinGD X72DF/1.1/1.2/2.1/2.2 FUEL-GAS-SYSTEM

TRACK CHANGES

DATE	SUBJECT	DESCRIPTION
2016-11-02	DRAWING SET	First web upload
2018-10-02	DAAD908560	Main drg – new revision
2019-01-31	DAAD908561	System drg – new revision
2019-06-15	DAAD104074 DAAD104072	Main and system drg. with iGPR layout - added
2020-02-28	DAAD104072	System drg – new revision
2020-08-19	DAAD104072 DAAD908560	System and main drg – new revision
2020-09-08	DAAD104072	System drg – new revision
2021-04-27	DAAD104072 DAAD908561	System drgs – new revision
2021-12-06	PAAD302406 PAAD302404 PAAD908033 PAAD194779	System and main drg – new revision
2022-08-24	PAAD302404 PAAD194779	System drg – new revision

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