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
1	PAAD332797	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.

Prod.

Change History

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

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
Main Design			Design Group	9727	Q-Code XXXXX	Standard WDS
Qty per			A4	Item ID	PTAA016714	Drawing Page/s 1/1

SEQ NO	QTY	Item ID	Item Name Dimension	Standard-ID	Basic Material	Net Weight
001	1	PAAD332796	FUEL GAS SYSTEM			0.001
003	1	PAAD278947	FLUSHING INSTRUCTION PIPING			0.001
004	1	PAAD149646	ENGINE SAFETY CONCEPT DF ENGINE SAFETY CONCEPT			0.001

Prod.			
	6 CX40DF 5,6,7,8 X40DF-1.0		

Change History

Rev.	Creator	Approver	Approval Date	Change ID	Change Synopsis	Activity Code	E	C
A	sde101	mhu019	10.11.2021	CNAA000939	Main Design/Drawing Introduced		4	3
-	sde101	mhu019	06.09.2019		-		-	-

WIN GD
Winterthur Gas & Diesel

FUEL GAS SYSTEM

Bill Of Material

Dimension							
Units	[m] [kg]	Basic Material				Net Weight	0.001
Main Design	Yes	Design Group	9727	Q-Code	XXXXX	Standard	WDS
Qty per	Engine	A4	Item ID	PAAD332797		BOM Page/s	01/01

Fuel type	Execution
Natural Gas (NG)	PAAD332797
Natural Gas (NG) + Volatile organic compounds (VOCs)	PAAD332798

Quantity PER ENGINE (PAAD332798)	Quantity PER ENGINE (PAAD332797)	SEQ NO	Material ID	Material Name / Dimension, Occ	Standard or Drawing	Basic Material / Material Standard	Weight GR./NET
1	1	004	PAAD149646	ENGINE SAFETY CONCEPT DF ENGINE SAFETY CONCEPT	DAAD046594		0,001
1	1	003	PAAD278947	FLUSHING INSTRUCTION PIPING	DAAD094163		0,001
1	-	002	PAAD332794	GAS FUEL SYSTEM NG/VOC	DAAD118512		0,001
-	1	001	PAAD332796	GAS FUEL SYSTEM NG	DAAD118513		0,001
Net Weight 0,001	Net Weight 0,001						

Free space for lic.

Q-Code: XXXXX
Standard: ISO; JIS
Main Drw.: H

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

WIN GD
Winterthur Gas & Diesel

Product: W5-8X40DF

GAS FUEL SYSTEM

Gas Brennstoffsystem

Units	mm kg	NX	
Basic Material		Net Weight	
Made	04.07.2019 Sudant Deogade	Scale	-
Chkd	06.09.2019 cku010 Claudio	Design Group	9727
Appd	06.09.2019 mhu019 Hug		
Size	A3	Page	1/1
Material ID			
Drawing ID	DAAD118515	Rev.	–

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

Approved

DID - DIMENSIONAL DRAWING - Confidential

SPECIFICATIONS which must be met:

(82) (D)

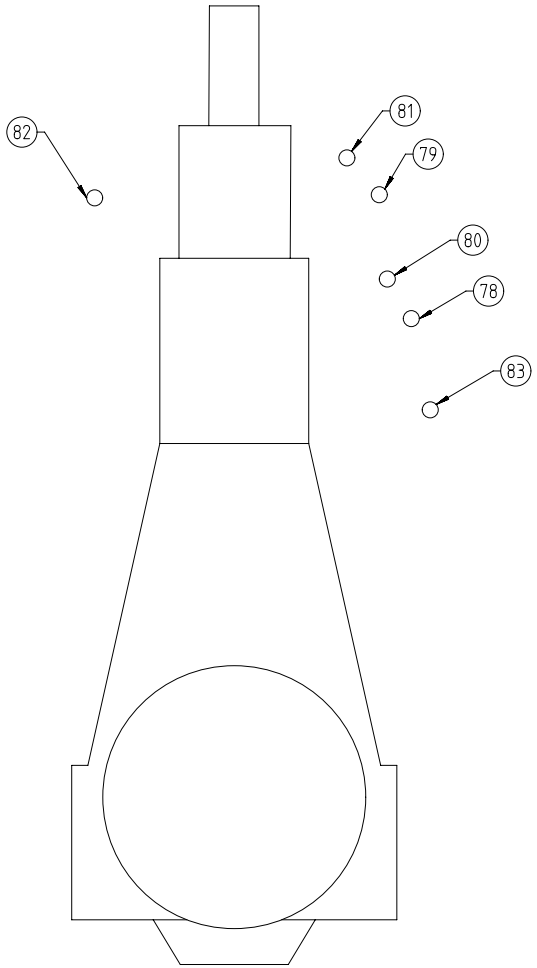
OUTLET - Gas monitoring, piston underside

- 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) (D)

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) (D)

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) (D)

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) (D)

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) (D)

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. CX40DF X40DF-1.0

Change History

Rev.	Creator	Approver	Approval Date	Change ID	Change Synopsis	Activity Code	E	C
D	sde101	mhu019	10.11.2021	CHAN00999	Drawing Updated		4	3
C	sde101	mhu019	04.09.2020	EAAD094556	Legacy information. See corresponding ChangeNotice		4	3
B	sde101	dst009	14.08.2020	EAAD093769	Legacy information. See corresponding ChangeNotice		4	3
-	sde101	mhu019	06.09.2019		-		-	-

Approved

WIN GD Winterthur Gas & Diesel

FUEL GAS SYSTEM
Gas Pressure Regulation: iGPR

Dimension

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

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

Main Design | Design Group 9727 - | Q-Code XXXXX | Standard WDS

Qty per | A2 | Item ID PAAD332796 | Drawing Page/s 1/2

SYSTEM PROPOSAL

NOTE (D)
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".

Double-wall pipes: normal operation: inner pipe - gas, annular space - air; inerting procedure: inner pipe - nitrogen, annular space - air

Vent pipes

Air pipes

Pipe connections

Orifice

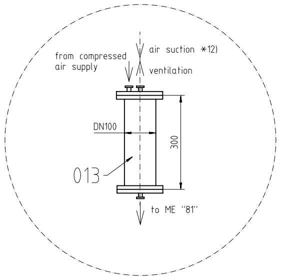
ENGINE ROOM

MAIN ENGINE AREA

Pos.	System Components *2) (D)
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 (D)	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 (D)	Manual shut-off valve engine gas supply *20)
022 (D)	Manual shut-off valve ancillary gas supply
023	Pressure regulating valve ancillary gas supply
024	Pressure regulating valve annular space air supply
025 (D)	Inert gas supply system *17)

Pos.	Engine Components *3) (D)
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)

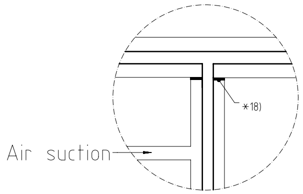


DETAIL A
SCALE 1:6

Table 1: Volume of ME internal gas piping

Cylinder	Volume of inner pipe (l)*	Volume of annular space (l)*
5 cyl.	210 l	50 l
6 cyl.	230 l	55 l
7 cyl.	250 l	60 l
8 cyl.	280 l	65 l

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



DETAIL B
SCALE 1:10

Remarks: (D)

*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 (018) 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 (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 quality: According to the specification in the MIM.

*7.1) 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.
*7.2) Gas detection in the engine room above the ME and the iGPR: Required according to the "WinGD 2-S Dual-Fuel Engine Safety Concept".
*7.3) Gas detecton for piston underside (PUS) with feedback to the engine control system: Mandatory
*7.4) 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 020.

*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) Condition 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-x, i.e. dew point ≤ 3 °C).
- From the air dryer (must comply with the ISO 8573-1, class x-4-x, 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 bar(g)).
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 mode 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 volume from the main engine's 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 iGPR on the ME side.

*14) To restrict the amount of vented gas, it is recommended that valve 006 closes in a reasonably short time.

*15) The purging valve must be located as close as possible and downstream of the master engine valve (pos. 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.

*16) 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 bar(g). Once set-pressure is selected, deviation of ± 10% is allowed, though not below 3 bar(g).

*17) It includes all components for inert gas storage and handling, (e.g. the tank, the pressure regulation, etc.)

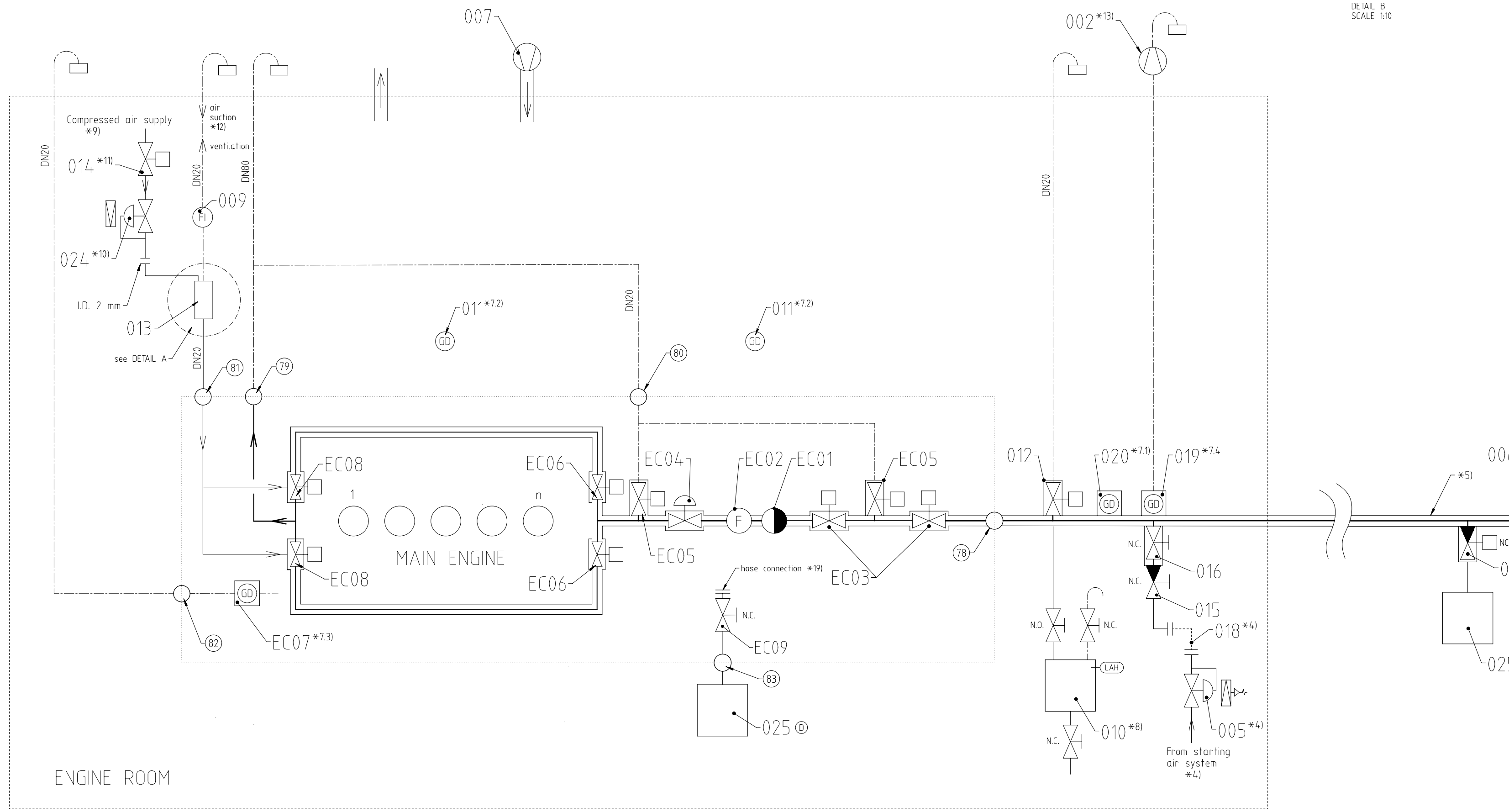
*18) The annular space of the piping for the other gas consumers must be disconnected from the annular space of the ME gas piping, e.g. separated air suctions for the other gas consumers are required.

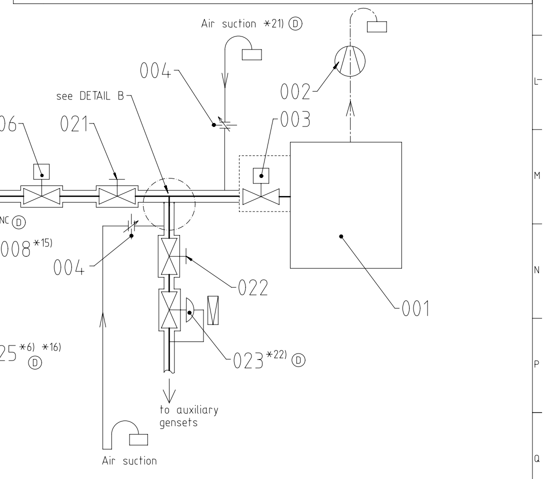
*19) Connection only temporarily used or opened for maintenance of the flowmeter. To be disconnected during normal operation.

*20) 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.

*21) 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.

*22) Conditional requirement - The master gas fuel engine valve must only be installed if there is a branch pipe to the other gas consumers.





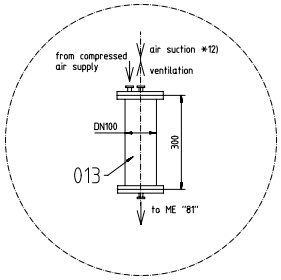
SURFACE PROTECTION SEE GROUP 0344
TOLERANCING PRINCIPLE ISO8015
GENERAL TOLERANCES ACCORDING TO ISO2768-mK

[mm] [kg] - NX A0 Item ID PAAD332796 Drawing Page/s 2/2

SYSTEM PROPOSAL

Double-wall pipes: (normal operation: inner pipe – gas, annular space – air; inerting procedure: inner pipe – nitrogen, annular space – air)
Vent pipes
Air pipes
Pipe connections
Orifice

ENGINE ROOM
MAIN ENGINE AREA



DETAIL A
SCALE 1:6

Table 1: Volume of ME internal gas piping

Cylinder	Volume of inner pipe (I)*	Volume of annular space (I)*
5 cyl.	210 l	50 l
6 cyl.	230 l	55 l
7 cyl.	250 l	60 l
8 cyl.	280 l	65 l

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

Pos.	System Components
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 *3)
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)
017	Double-block and bleed valve
018	Intermediate piece
019	Gas detector ship side *7.4)
020	Gas detector engine side *7.1)
021	Manual stop valve engine gas supply *20)
022	Manual stop valve ancillary gas supply
023	Pressure regulating valve ancillary gas supply
024	Pressure regulating valve annular space air supply

Pos.	Engine Components
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 *15)
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)

Remarks:

*1) The exact position and pipe connection execution please refer to the "Pipe Connection Plan".

*2) 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 the ME gas piping.

*3) Conditional requirement – Only to be installed if there is a branch pipe to the other gas consumers.

*4) Compressed air supply is required for leakage testing of 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 (018) 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 (layout of the counter-flange is provided in the "Pipe Connection Plan").
Pipe section installed below the main deck, in 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 / weather deck:
Single-wall pipe with diameter of DN50 is recommended, if the position fulfils the rule requirements of non-hazard zone.

*6) Inert gas quality: According to the specification in MIM.

*7.1) Gas detection for annular space, with feedback to engine control system: mandatory.
Must be installed with a distance of max. 2m to engine inlet.
*7.2) Gas detection in engine room above ME and iGPR: Required according to WinGD "2-S Dual-Fuel Engine Safety Concept".
*7.3) Gas detecton for piston underside (PUS), with feedback to engine control system: mandatory
*7.4) Gas detection for annular space, on ship side: Optional – to distinguish between system and engine side leaks. If the optional gas detector is not installed, the ventilation line with extraction fan has to be connected to gas detector 020

*8) Conditional requirement – If the gas temperature is not always higher than the ambient air temperature, condensate may accumulate in 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.

*9) Conditional requirement – No condensate is allowed in the ME 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 control air supply (fulfill the ISO 8573-1, class x-4-x, i.e. dew point ≤ 3 °C).
– From air dryer (fulfill the ISO 8573-1, class x-4-x, i.e. dew point ≤ 3 °C).
– From working air supply (as long as 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 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 mode 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) Extraction fan must have the capacity to exchange the ventilation air at minimum of 30 times per hour. Please consider the annular volume from ME piping (from Table 1) and the additional annular volume from the ship side piping.

*15) Has to be located as close as possible and downstream of the master engine valve (pos. 006). Can be connected inside or outside of the engine room.

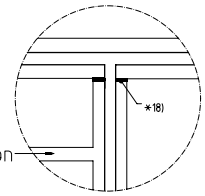
*16) Inert gas consumption: Calculated according to the guidance in the Marine Installation Manual (MIM) under consideration of the in table 1 provided ME inner pipe volume.
Inert gas pressure: Can be selected between 3 and 15 bar(g). Once set-pressure is selected, deviation of ± 10% is allowed, though not below 3 bar.

*17) To be installed according to class requirements.

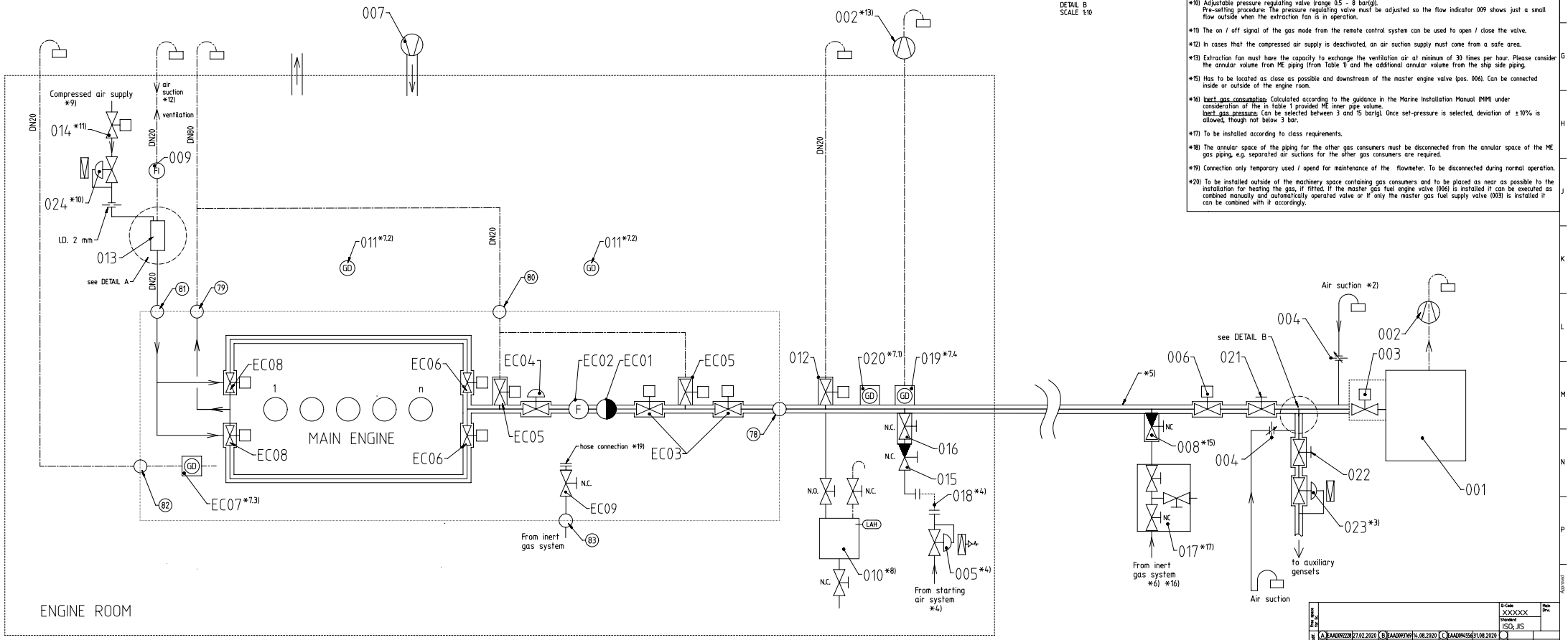
*18) The annular space of the piping for the other gas consumers must be disconnected from the annular space of the ME gas piping, e.g. separated air suctions for the other gas consumers are required.

*19) Connection only temporary used / opend for maintenance of the flowmeter. To be disconnected during normal operation.

*20) To be installed outside of the machinery space containing gas consumers and to be placed as near as possible to the installation for heating the gas, if fitted. If the master gas fuel engine valve (006) is installed it can be executed as combined manually and automatically operated valve or if only the master gas fuel supply valve (003) is installed it can be combined with it accordingly.



DETAIL B
SCALE 1:10



Mark	Rev. no.	Number	Drawn date	Number	Drawn date	Number	Drawn date	Number	Drawn date
	A	KAAD892228	27.02.2020	B KAAD893749	14.06.2020	C KAAD894556	31.08.2020		

G-Code: XXXXX
Standard: ISO, JIS
Main Drw.

Product: 5-8X40DF-1.0

GAS FUEL SYSTEM
Gas Supply System: NG
Gas Brennstoffsystem
Gas Pressure Regulation: iGPR

Units	mm kg	NX	Basic Material:	Net Weight 0,001
SURFACE PROTECTION SEE GROUP 9744	Made 04.07.2019 Sudant Deogade	Scale -	Size A0	Page 2/2
TOLERANCING PRINCIPLE ISO8015	Chkd 06.09.2019 claud10 Claudio	Design Group 9727	Drawing ID DAAD118513	Material C
GENERAL TOLERANCES ACCORDING TO ISO2768-mK	Appd 06.09.2019 stiu019 Hug			Rev. C

PAAD332796

SPECIFICATION which must be met:

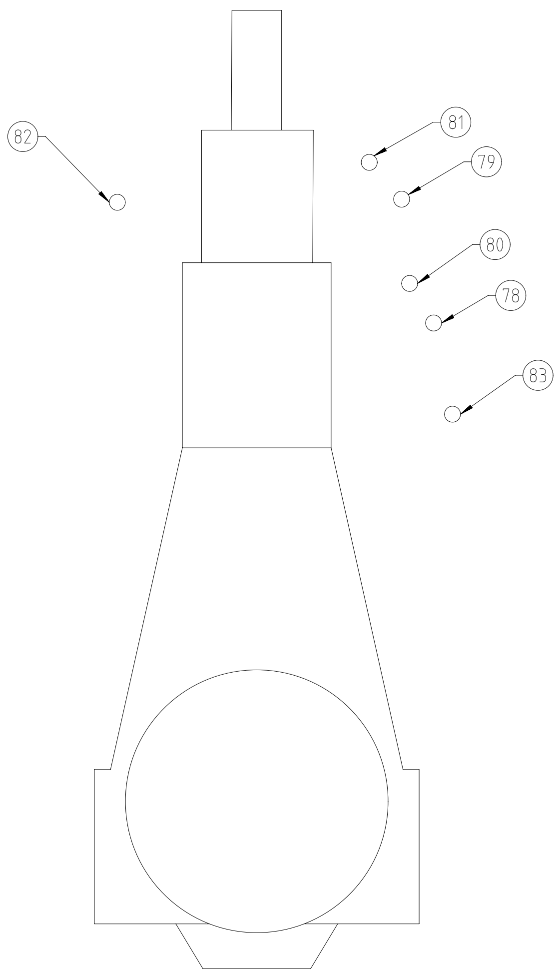
(82) OUTLET - Gas monitoring, piston underside

- Must not be connected to other venting pipes.
- Gas release to safe area outside of engine room.
- At the end of the vent pipe, safety devices e.g. flame arrestors have to be installed according to 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 close / blinded off during normal operation
Inert gas quality: According to specification in Marine Installation Manual (MIM).

X40DF-1.0



(78) INLET - Gas supply

INNER GAS PIPE
Gas quality: According to project specific definition
Gas pressure: Project specific as defined by the system designer, considering the heat value of the fuel gas mixture (NG+VOC).
The minimum required NG pressure needed for an reliable ME operation is provided by GTD.
Permissible gas pressure fluctuation: ± 0.6 bar (across all frequencies).
Mass flow: according to project specific definition
Gas temperature:
40 - 60 °C for pure NG and for the mixture of NG and VOC up to max. 25% of VOC.
Pipe connection: Inner pipe connected to the gas supply system via adapter piece.
Inert gas supply: An inert gas supply must be connected upstream to the iGPR right after the master gas fuel supply valve to enable purging of the whole system+engine piping (in the Wärtsilä Fuel Supply System both componets are already included).
Inert gas quality: According to specification in Marine Installation Manual (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) - annular space ventilation air outlet
Ventilation air quantity and quality: same specification as for connection 81, "INLET - Ventilation air annular space".
Pipe connection: Outer pipe connected to the annular space venting via an adapter piece.

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 / furthest from the engine inlet.
Interruption of gas supply: The main gas supply line to each consumer or set of consumer must be equipped with a manually operated stop valve and an automatically operated "master gas valve" coupled in series or executed as a combined manually and automatically operated valve.
The valves shall be situated in the part of the piping that is outside the machinery space containing gas.

(79) OUTLET - Gas / Inert gas release, engine driving end

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

(80) OUTLET - Gas / Inert gas release, engine free end

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

(81) INLET - Ventilation air annular space

- Air suction from a gas safe area
- Execution of the air suction pipe according to the concept as provided in the "2-S Dual Fuel Safety Concept" (linked on the main drawing of this design group)
- Ventilation air flow on ME side: min. 30 air exchanges per hour
  Annular space volume for calculation of extraction fans capacity: see table 1 on page 2.

Free space for lic.							Q-Code XXXXX / Standard ISO; JIS	Main Drw.
Modif.	(A) EAAD092228 (Number)	27.02.2020 (Drawn date)	(B) EAAD093769 (Number)	14.08.2020 (Drawn date)	(C) EAAD094556 (Number)	01.09.2020 (Drawn date)	( ) Number	Drawn date

WIN GD Winterthur Gas & Diesel

Product: 5-8X40DF-1.0

GAS FUEL SYSTEM
Gas Supply System: NG+VOC
Gas Brennstoffsystem
Gas Pressure Regulation: iGPR

SURFACE PROTECTION SEE GROUP 0344	Units mm kg	NX	Basic Material	Net Weight 0,001
TOLERANCING PRINCIPLE ISO8015	Made 04.07.2019 Sudant Deogade	Scale -	Size A2 / Page 1/2	Material ID PAAD332794
GENERAL TOLERANCES ACCORDING TO ISO2768-mK	Chkd 06.09.2019 cku010 Claudio / Appd 06.09.2019 mhu019 Hug	Design Group 9727	Drawing ID DAAD118512	Rev. C

Approved

DID - DIMENSIONAL DRAWING - Confidential

SYSTEM PROPOSAL

Double-wall pipes:	normal operation:	inner pipe - gas; annular space - air
	inerting procedure:	inner pipe - nitrogen; annular space - air
Vent pipes		
Air pipes		
Pipe connections		
Orifice		

ENGINE ROOM

MAIN ENGINE AREA

Pos.	System Components
001	Fuel Gas Supply System (FGSS)
002	Extraction fan
003	Engine room ventilation fan
004	Gas detector engine room *4.2)
005	Adapter piece *6)
006	Shut-off valve (double-wall execution)
007	Non-return valve
008	Intermediate piece
009	Bleeding valve
010	Gas detector annular space, gas supply pipe *4.1)
011	Pressure reduction valve

Pos.	Engine Components
EC01	Gas filter
EC02	Flowmeter
EC03	Shut-off valve
EC04	Vent valve
EC05	Pressure regulating valve
EC06	Bleeding / vent valve
EC07	Shut-off valve gas rail pipe
EC08	Gas detector piston underside
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 *10)

Remarks:

*1) The excact position and pipe connection execution please refer to the "Pipe Connection Plan".

*2) Compressed air supply is required for leakage testing of gas fuel system pipelines and components. Air is supplied from the starting air system, then air pressure is reduced by the regulating valve (011) 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 blinded off.

*3) Inert gas quality according to the specification in the Marine Installation Manual (MIM).

*4.1) Gas detection for annular space, with feedback to engine control system: mandatory. Must be installed with a distance of max. 2 m to engine inlet.
*4.2) Gas detection in engine room above ME and iGPR: Required according to WinGD "2-S Dual-Fuel Engine Safety Concept".
*4.3) Gas detecton for piston underside (PUS), with feedback to engine control system: mandatory.

*5) Extraction fan must have the capacity to exchange the ventilation air at minimum of 30 times per hour. Please consider the annular volume from ME piping (from Table 1) and the additional annular volume from the ship side piping.

*6) The adapter piece (005) in between the FGSS (001) and ME connection flange has to be prepared by the shipyard / gas pipe supplier accordingly. It must provide the following functions:
- ME annular space ventilation air outlet with gas detector
- Separation of the ME annular space from the annular space of the FGSS.

*7) In order to keep the temperature of the fuel gas mixture (NG+VOC) in the specified range of 40 - 60°C it is recommended to apply on the piping in the fuel gas supply line and on ME side insulation.

*8) The master gas fuel supply valve, inert gas inlet and venting outlet is included the gas supply system.

*9) Depending on the requirements / setup to be installed either on system side and / or included in the gas supply system.

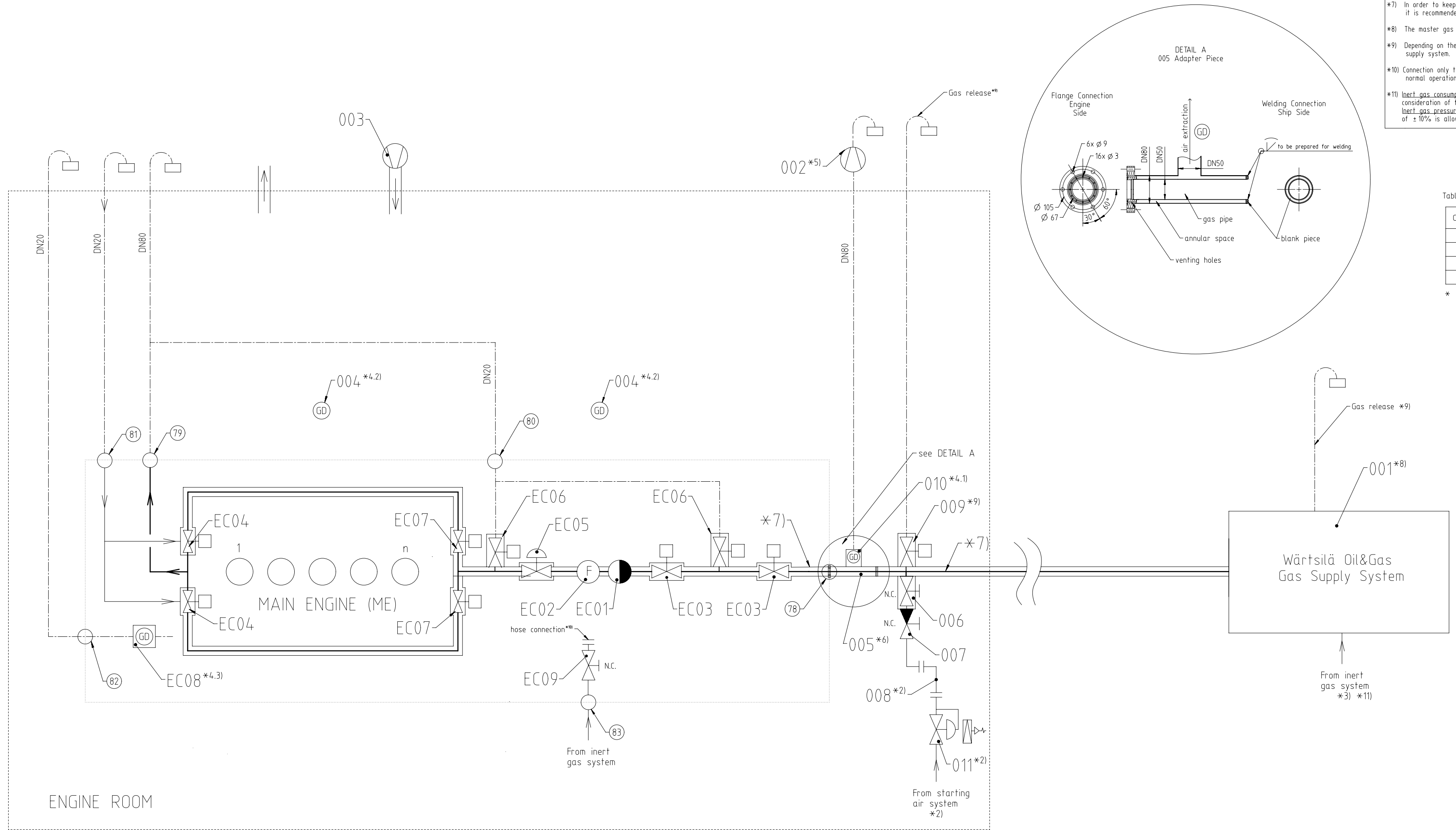
*10) Connection only temporary used / opend for maintenance of the flowmeter. To be disconnected during normal operation.

*11) Inert gas consumption: Calculated according to the guidance in the Marine Installation Manual (MIM) under consideration of the in table 1 provided ME inner pipe volume.
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.

Table 1: Volume of ME internal gas piping

Cylinder	Volume of inner pipe (l)*	Volume of annular space (l)*
5 cyl.	210 l	50 l
6 cyl.	230 l	55 l
7 cyl.	250 l	60 l
8 cyl.	280 l	65 l

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



Free space for lic.				Q-Code XXXXX	Standard ISO; JIS	Main Drw.
Modif.	A EAAD092228 (Number) 27.02.2020 (Drawn date)	B EAAD093769 (Number) 14.08.2020 (Drawn date)	C EAAD094556 (Number) 01.09.2020 (Drawn date)	Number	Drawn date	
WIN GD Winterthur Gas & Diesel	Product 5-8X40DF-1.0	GAS FUEL SYSTEM Gas Supply System: NG+VOC Gas Brennstoffsystem Gas Pressure Regulation: iGPR				
Units mm kg	NX	Basic Material	Net Weight 0,001			
SURFACE PROTECTION SEE GROUP 0344	Made 04.07.2019 Sudant Deogade	Scale -	Size A0	Page 2/2	Material ID PAAD332794	
TOLERANCING PRINCIPLE ISO8015	Chkd 06.09.2019 cku010 Claudio	Design Group 9727	Drawing ID DAAD118512	Rev. C		
GENERAL TOLERANCES ACCORDING TO ISO2768-mK	Appd 06.09.2019 mhu019 Hug					

Approved

DID - DIMENSIONAL DRAWING - Confidential

MIDS_WinGD-X40DF-1.0_GAS-FUEL-SYSTEM (DG9727)

TRACK CHANGES

DATE	SUBJECT	DESCRIPTION
2019-09-09	DRAWING SET	First web upload
2020-02-28	DAAD118513 DAAD118512	System drgs – new revision
2020-08-19	DAAD118512 DAAD118513	System drgs – new revision
2020-09-08	DAAD118512 DAAD118513	System drgs – new revision
2021-11-25	PAAD332796 PAAD332797	System drgs – new revision

Winterthur Gas & Diesel Ltd.
Winterthur Gas & Diesel AG.
Winterthur Gas & Diesel S.A.

Schützenstrasse 3
PO Box 414, CH-8401
Winterthur, Switzerland

Tel. +41 (0)52 264 8844
Fax +41 (0)52 264 8866