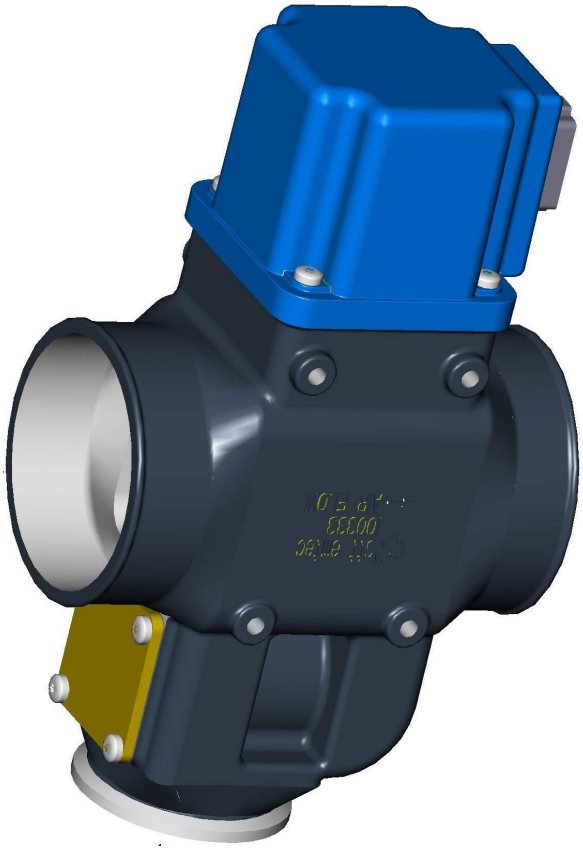
DNOx *marine*

NOx reduction technology by STT Emtec AB

Installation Guideline



This guideline describes the recommended installation procedure and maintenance for the STT DNO*x marine* system
This document is an addendum to the CCT*marine* Installation Guidline
Latest version available at www.sttemtec.com

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1 Purpose

The purpose of this document is to give sufficient information on how to use and install the key components of the DNO$_X$*marine* system. The installation guideline also describes the post adjustments and inspection processes and gives general information on service and maintenance. The DNO$_X$*marine* a sub-system of the CCT*marine* system and is not intended for stand-alone operation or installation. This document should therefore be read in conjunction with the CCT*marine* system installation guideline.

2 DNO$_X$*marine* technology

2.1 Operating principles

DNO$_X$*marine* is a clean low-pressure EGR (Exhaust Gas recirculation) system. Low-pressure means that the exhaust gas is filtered and cooled and mixed with intake air before entering the turbocharger / engine. A proportionally controlled EGR valve adjusts the mix between intake air and exhaust gas (EGR rate). The water and carbon dioxide content of the re-circulated exhaust gas reduces formation of nitrogen oxides in the combustion process.
DNO$_X$*marine* must be used in conjunction with CCT*marine* which is an actively regenerated particulate filter. The EGR valve (EGR rate) is controlled by a calibration table residing within the CCT*marine* control system.
An EGR pickup is installed in the exhaust pipe to create a positive pressure driving the recirculated part of the exhaust gas through the EGR valve. An in-line EGR cooler is connected to the engine coolant water to reduce the temperature of the recirculated gas. A secondary filter (EGR filter) is inserted before the EGR valve to prevent any foreign particulates from entering the engine and turbocharger inlet.

Note! The fuel quality for the DNO$_X$*marine* system must be EN590:2009. To use other fuel qualities first consult STT Emtec.

2.2 System layout

The schematic diagram in *Figure 1* shows the layout of the DNO$_X$*marine* system.

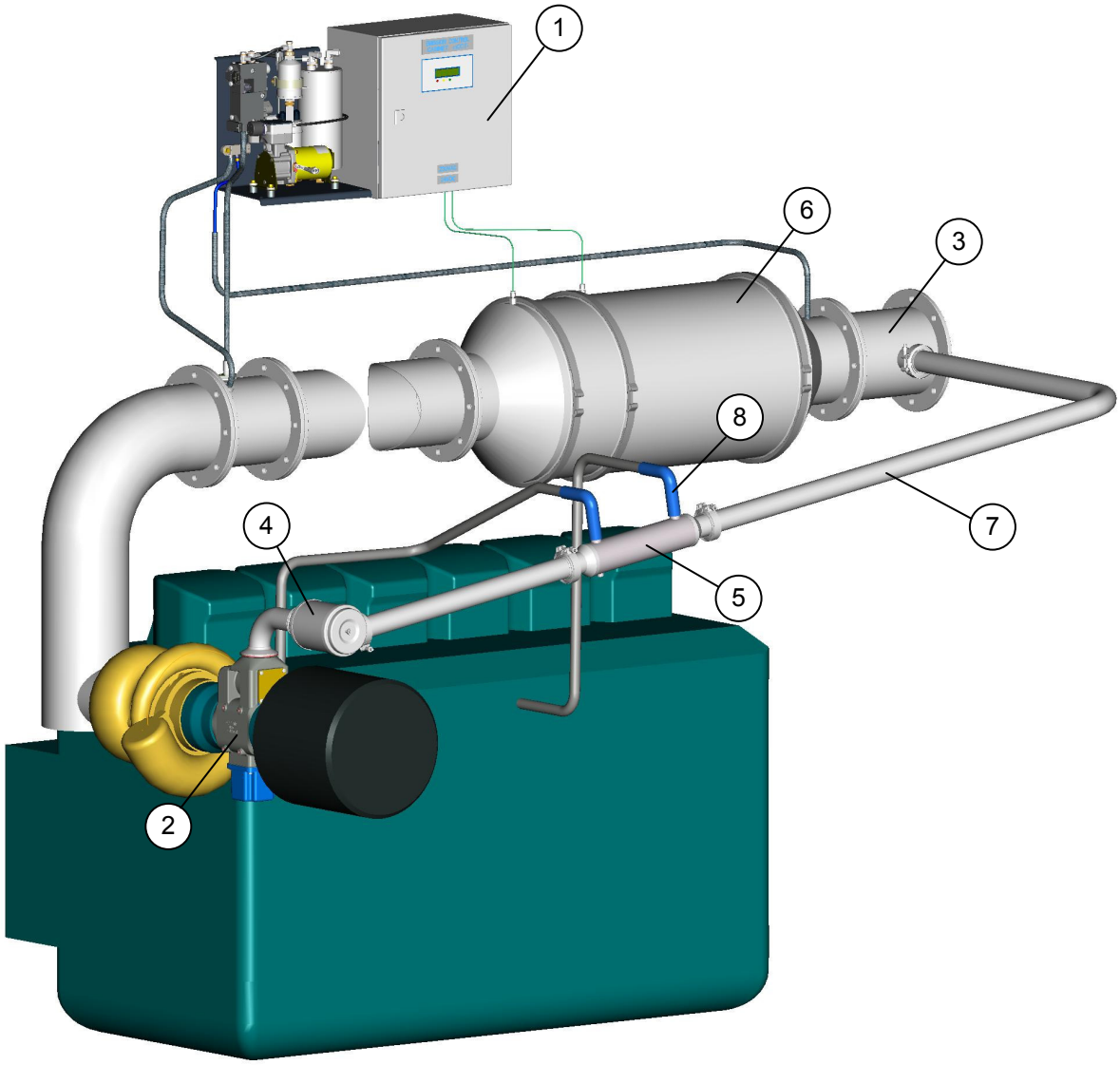


Figure 1 System overview

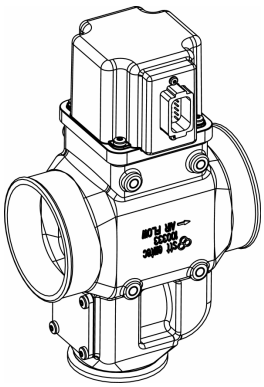
1. Control cabinet (part of CCTmarine system), 2. EGR valve, 3. EGR pickup,
4. EGR filter, 5. EGR cooler, 6. Particulate filter (part of CCTmarine system),
7. EGR piping, 8. Coolant hoses

3 System key components

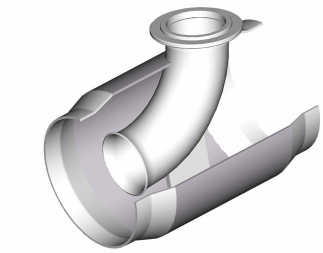
3.1 Components overview

The following are the key components of the DNO$_X$*marine* control system. The sensor assembly is optional. Appearance may vary slightly between specific systems.

Figure 2 Key components

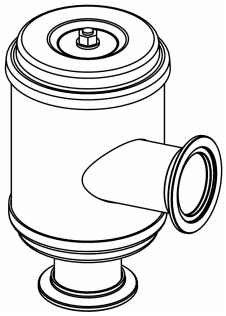


EGR VALVE



EGR PICKUP

EGR COOLER



EGR FILTER

SENSOR ASSEMBLY

WIRING HARNESS

3.2 EGR valve

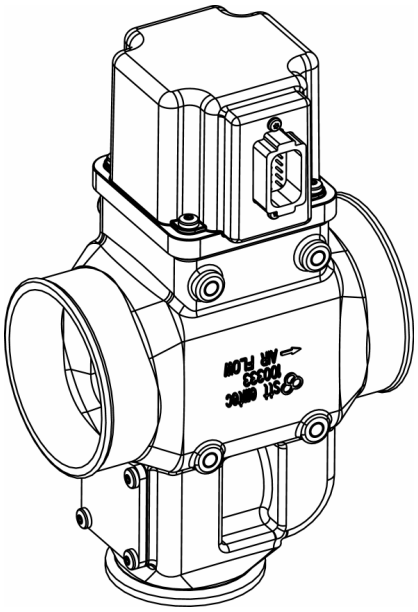


Figure 3 EGR valve

Function

The EGR valve control the mixture of ambient intake air and recirculated (cooled) exhaust gas, i.e. the EGR rate. In a typical application up to about 10% of exhaust gas is recirculated into the engine. The EGR rate is calibrated for each specific engine/application. The EGR valve is controlled by the Control cabinet via CAN bus (Controller Area Network).

Installation

The EGR valve shall be positioned between the air cleaner and the turbo charger and mounted fixed to the chassis with a bracket designed for the installation. For mounting, the valve has 4x M8 threaded holes on each side of the housing. To minimize pressure loss the valve should be installed as close as possible to the turbo charger and at the same time with sufficient distance for the inlet pipe/hose to handle relative movements. A clearance of at least 25mm between the valve and engine parts is recommended.

Inlet air is routed to the valve according to figure 4.
If the valve is mounted close to the exhaust manifold a heat shield is required to protect the electronic actuator.

There are several design solutions for connecting the EGR valve to the turbocharger, some examples are:

1. Standard hose or rubber bellow, with enough length for relative movements, can be used if the distance to the turbo and the relative movements allow so.
2. Rubber bellow - pipe - rubber bellow. The pipe and rubber connections works as a link which is preferred if the relative movements are considerable.
3. Compression moulded hose with enough length or with bellow function. This may be required in narrow installations.

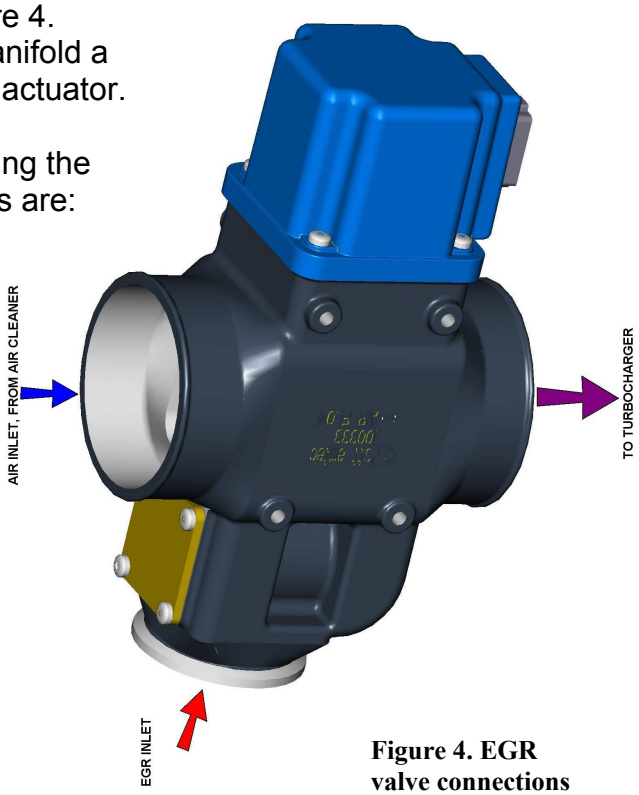


Figure 4. EGR valve connections

Regardless of design the inlet hose/pipe must stand negative pressure conditions before the turbo (at least -100 mbar) without collapsing. The material shall withstand corrosion (moist), oil and engine temperatures approx. 85˚C. Suitable materials for the inlet pipe are aluminium, stainless steel or plastic (e.g. HDPE).

If crankcase ventilation is connected to the inlet pipe the connection must be positioned upstream the EGR valve.

If the supply for an air compressor is boosted from the engine inlet manifold the connection must be relocated to a position before the EGR valve unless the pressurized air system can tolerate exhaust gas.

Same conditions apply for design of connection between the air cleaner and the EGR valve, especially when the air cleaner can move relative to the EGR valve. It's important to use standard hoses or design compression moulded hoses that can withstand the depression on intake side. They shall also be designed for good air flow to achieve depression levels compared to standard inlet system.

Maintenance

A function test of the EGR valve and an inspection of the built-in strainer should be carried out every 1500 running hours.

1. Dismount the v-clamp on the EGR side of the valve.
2. Dismount the strainer (figure 6). If the strainer only is slightly colored black from soot and the mesh is open for air to pass through, continue to step 5.
3. If the strainer is colored black from soot and the mesh is blocked, the function of both the particulate filter (DPF) and EGR filter must be verified. If the trap is damaged the DNOx system must be turned off until it is replaced.
4. Dismount the return pipes and clean them inside.
5. Clean the strainer.
6. Mount the strainer and EGR pipes
7. Test of valve function. See Appendix 4: Post installation and inspection; section EGR valve.

Figure 5. EGR valve. The arrow shows where the EGR damper is located

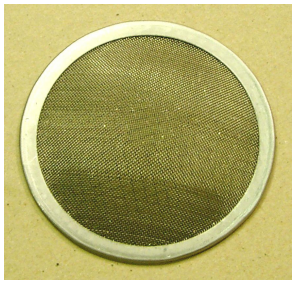


Figure 6. Strainer

Pos	P/N	Description
1	Customer specific	EGR valve
2	101031	Strainer

Note! The valve is part of the inlet system and therefore high cleanliness and airtight connections are required. This is a crucial aspect during handling of this part.

3.3 EGR pickup

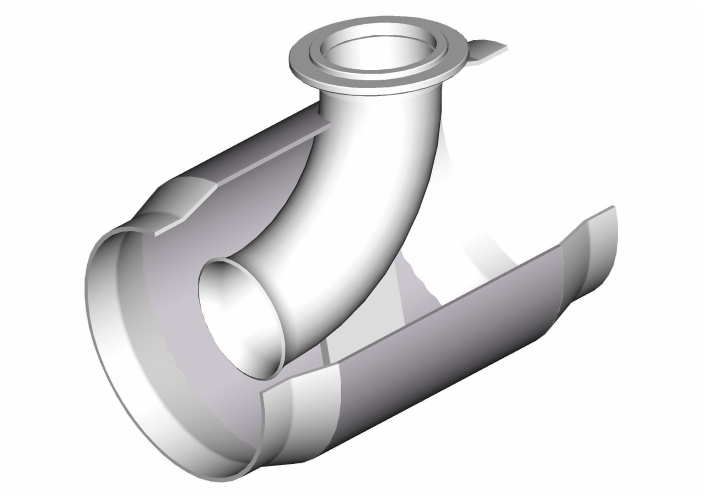


Figure 7. EGR pickup

Function

The EGR pickup captures a part of the particulate-free exhaust downstream the particulate filter (DPF). Together with the EGR valve it creates a positive pressure which drives the EGR flow without imposing any significant backpressure on the exhaust system.

Installation

The pickup is fitted downstream the particulate filter (DPF) not closer than 1m from the tail pipe in order to prevent ambient dust from entering the EGR loop. Connection to the exhaust pipe is application dependant. Standard bolt type flanges are: Ø102 – Ø204mm. The flange to the EGR line is a 50.8mm male V-clamp type.

Maintenance

Inspect EGR pipes for exhaust gas leakage every 1500h.

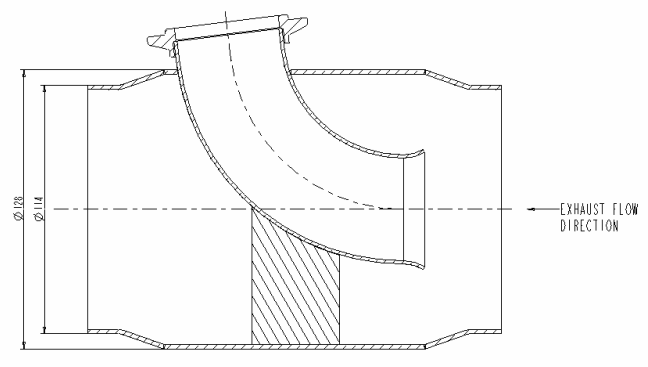


Figure 8. Exhaust gas flow direction

Pos	P/N	Description
1	108436	EGR pickup

3.4 EGR cooler

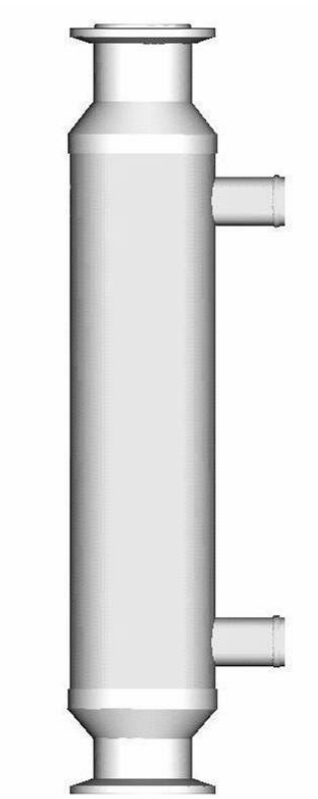


Figure 9. EGR cooler

Function

The EGR cooler lowers the hot exhausts to a temperature of about 150˚C before it is mixed with ambient air in the EGR valve.

Installation

The coolant connections (inlet and outlet) are designed to fit 25mm ID hoses. Two coolant inlet configurations are available:

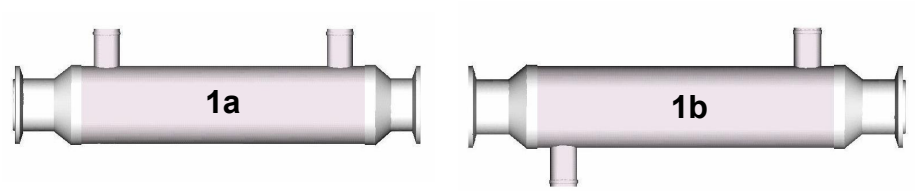


Figure 10. EGR cooler configurations

Pos	P/N	Description
1a	100787	EGR cooler, parallell connections
1b	100652	EGR cooler, opposite connections

To avoid air pockets in the cooler it must be mounted with the coolant outlet on the highest point (figure 11). The EGR return system should be angled all the way from the EGR valve to the EGR pickup to let condense flow back to the exhaust system.

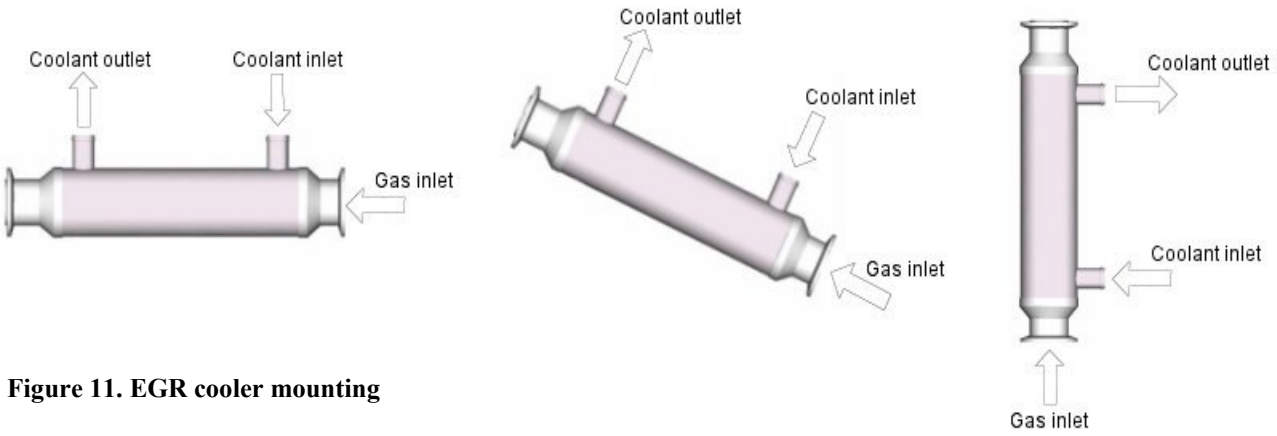


Figure 11. EGR cooler mounting

In installations which does not allow for an angled mounting of the cooler, focus must be put on avoiding water stand in the recirculation system. (*See also section: Piping*)
To obtain a good degree of efficiency of the cooler the coolant flow inlet should correspond to the EGR flow inlet.

The cooler ends are equipped with flanges mating the EGR pipe flanges (female flange on exhaust inlet side). The cooler shall be mounted fixed to chassis. Brackets for M10 bolts, with different bolt splits, are available where strong clamps can be used to hold the cooler. (*See also section: Piping*)

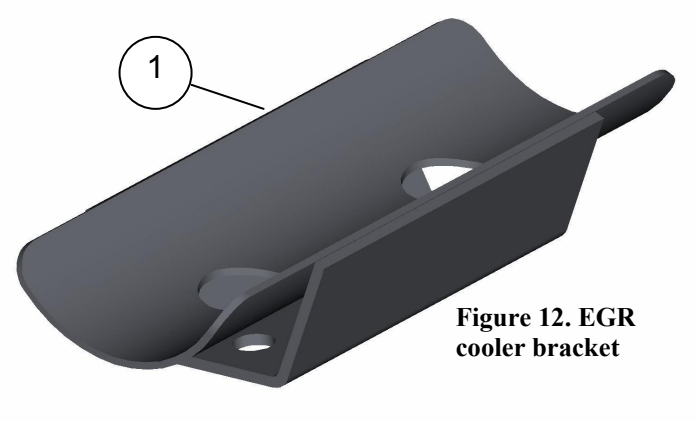


Figure 12. EGR cooler bracket

Pos	P/N	Description
1	100107	EGR cooler bracket, 180 mm bolt split

Insulation

Gas temperature at the cooler inlet is close to exhaust temperature at the pickup and insulation may be required.

Capacity

Capacity of the engine cooling system must be secured. In a typical installation about 10% of the exhaust gas is recirculated and cooled to approximately half the temperature before entering the EGR valve and engine intake system. This implies an increased cooling load of about 2-4% of the engine power rate.

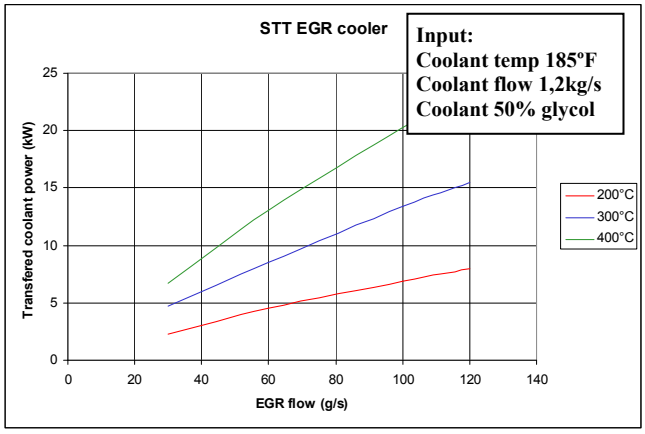


Figure 13. Engine coolant system power increment as a function of EGR flow and exhaust temperature

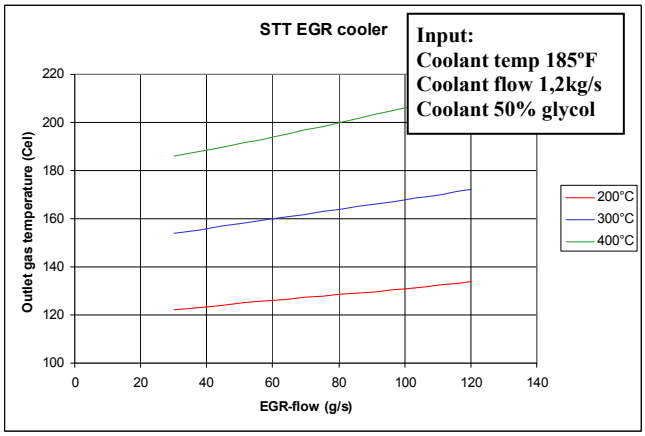


Figure 14. EGR cooler capacity as a function of EGR flow and exhaust temperature

Typical coolant flow trough the EGR cooler for a medium duty engine is about 1 kg/s (figure 15). To reach sufficient coolant flow, engine connections that result in adequate pressure difference must be located. For cooler inlet it's recommended to connect the coolant line directly after the engine coolant pump, on the engine block pressure channel, and return the coolant to the pump suction side.

Note! Regardless of engine temperature the EGR cooler needs coolant flow. Connections must therefore be put on the thermostat side that provides permanent flow.

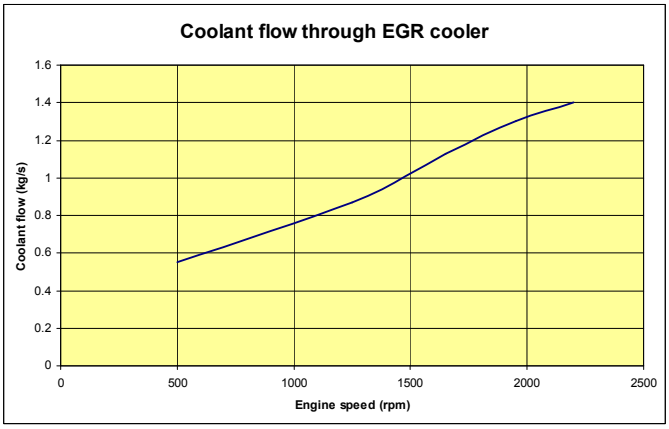


Figure 15. Coolant flow thru the EGR cooler for a medium duty diesel engine

Pipes and hoses

Coolant pipes/ hoses are used for transporting engine coolant to EGR cooler and return coolant to engine. For a well functioning coolant line it is recommended to use a combination of pipes and hoses. The material in pipes/ hoses can vary to adapt engine- and vessel manufacturer demands.
Pipes made of stainless steel, copper or powder coated alloy steel DIN 2394 is common.
Bulges are needed on pipe ends to prevent hoses from sliding off.
Longer pipes needs to be clamped either on engine or chassis, not both for same pipe.
The coolant lines must allow for movement between engine and chassis mounted parts. A coolant hose with sufficient length on the coolant line from the cooler to the engine must be used for taking care of this function.

Coolant hoses should be made of reinforced silicon or reinforced EPDM. Reinforcement is needed to withstand coolant system pressure, approx. 1bar.
Some engine manufacturers may only use hoses for the coolant system connection. This can also include the EGR cooler.
If hoses are used make sure to clamp well to avoid wear.

Maintenance

Inspect coolant lines for leakage every 1500h. Inspect EGR lines for exhaust gas leakage every 1500h

3.5 EGR filter

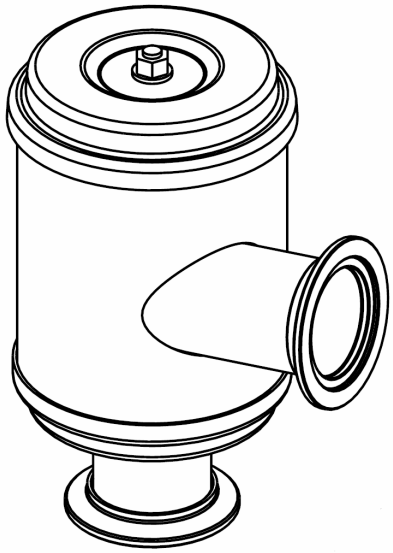


Figure 16. EGR filter

Function

Low-pressure EGR requires clean exhaust gas to be recirculated to the engine. Wear or damage can occur on the engine or turbocharger if the exhaust gas is not free from particulates. The particulates are normally absorbed in the particulate filter (DPF) but in the event of a damaged DPF or broken EGR lines the filter is designed to prevent foreign particles from entering the engine .

Installation

The secondary filter is mounted between the EGR cooler and the EGR valve. Depending on the installation the EGR cooler or EGR pipes may give sufficient support to the filter but in other installations a support bracket and a guillotine clamp or similar is recommended.

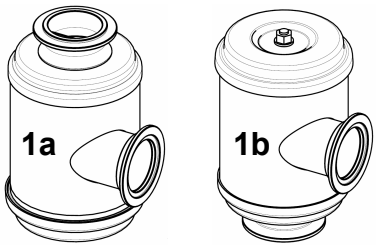
EGR gas enters at the housing side and exits through a pressed gable in the filter bottom. For proper sealing an FPM sealing ring is used between filter housing and the tightened lid (see figure 18). Two standard configurations of the secondary filter housing are available.

Maintenance

The EGR filter should be inspected every 1500h and replaced every 3000h.
Make sure that the filter is clean. Limited coloring from soot next to the gas inlet position is acceptable. If dust or dirt exists around the filter, the probable cause is leakage on the exhaust- or EGR return system. Inspect EGR lines for leakage every 1500h.

Figure 17. EGR filter canning configurations

Pos	P/N	Description
1a	102475	Canning type 1
1b	101326	Canning type 2
2	103093	Gasket
3	102528	Filter element
4	100930	Nut
5	101682	Service kit (2+3+4)



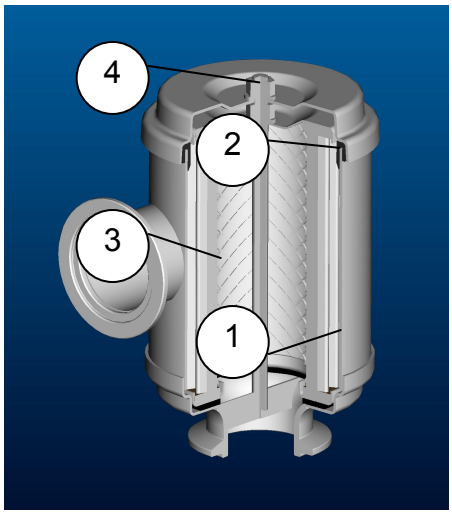


Figure 18. Cross section of EGR filter assembly (canning + filter)

Note! The secondary filter is part of the inlet system and therefore high cleanliness requirements on the component. No weld fleas, metal chip, dust or other loose particulates that can damage the engine may exist in the filter.

3.6 Sensor assembly

Figure 19 Sensor assembly

Function

Since Marine DNOx is a subsystem of Marine CCT most of the sensors required are already present in the CCT application. The following additional sensors may be required depending on the application:

1. *Inlet pressure*: Senses the pressure drop downstream the air cleaner. A clogged air cleaner/filter will have a great impact on the EGR rate.
2. *Inlet temperature*: Senses the ambient temperature. Prevents ice formation in the charge air cooler under cold conditions..
3. *Coolant water temperature*: Senses the engine coolant temperature. EGR is only active when the engine has reached working temperature. Above working temperature EGR rate is decreased to prevent thermal stress of the engine.

Installation

All electrical and pneumatic connections are subject to changes and differences can occur between applications. Make sure that the correct pneumatic and wiring diagram is used for the application at hand. The wiring diagram and detailed sensor installation requirements are given in the guidelines for Marine CCT. See also Appendix 1 for DNOx system wiring.

Inlet temperature

A hole for an M12x1.5 thread is drilled into the engine air intake where the sensor is fitted. The sensor head reaches 20mm below the thread. Make sure that at least 10mm of the sensor head is exposed to flowing intake air and not obscured by cast material.

Pos	P/N	Description
1	103195	Inlet temp sensor
2	103407	Inlet pressure sensor
3	103196	Coolant temp sensor

Inlet pressure

Drill and thread a hole for a nipple with a male hose barb in the inlet downstream the air cleaner but before the EGR valve, as close to the air cleaner as possible. Mount the pressure sensor at the hull at a position above the hose barb and route a hose between the sensor and the barb. To avoid condensate to be trapped in the hose there should be a continuous slope from the sensor to the barb.

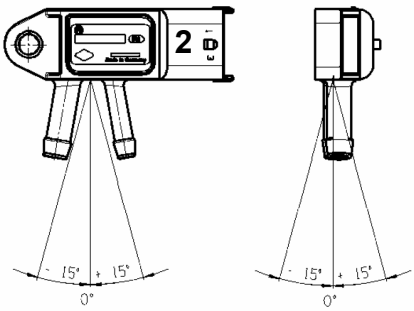


Figure 20 Pressure sensor mounting direction

Coolant water temperature

The sensor is mounted in coolant inlet hose to the EGR cooler in the supplied T-pipe.

Note! Ensure that the inlet pressure hoses are routed uphill from the barb to the pressure sensor to enable drainage of condensed water.

4 Piping

4.1 Material selection

The exhaust gas is returned from the pickup to the EGR valve through EGR pipes. The EGR pipes should be made from 50.8mm stainless steel pipe AISI 304, or better, quality.

4.2 Flanges

Male and female flanges are mounted on the pipe ends. The exhaust flow direction determines which type of flange to mount. Referred to flow direction (from dynamic pickup to EGR valve) the flange pair male-female should be mounted in mentioned order (figure 21). This creates a labyrinth sealing in the flanges which minimizes the leakage. The pair is clamped with a v-clamp.

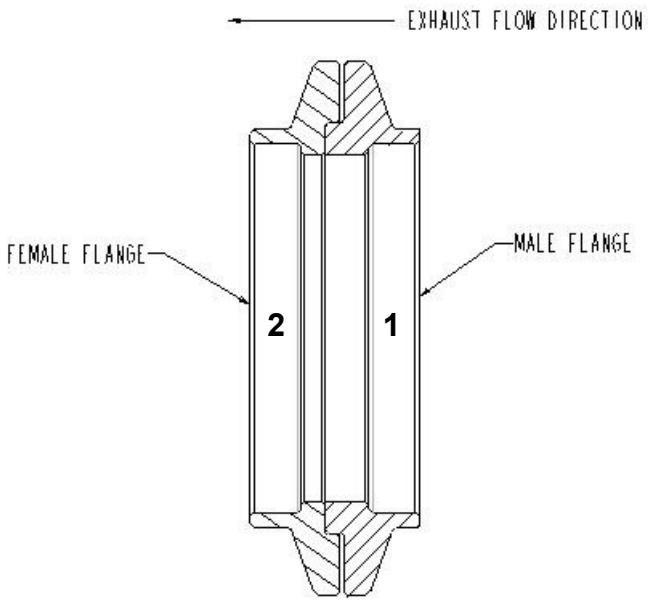


Figure 21. Flanges for the EGR system must be mounted in the order shown in the picture with respect to exhaust flow.

Pos	P/N	Description
1	100114	Male flange Ø50mm
2	100115	Fem flange Ø50mm
3	103112	V-clamp

4.3 Dimensions

The length of the EGR pipes shall be kept as short as possible to minimize pressure drop. Brackets for mounting the EGR pipes, secondary filter, EGR cooler and EGR valve should be designed to handle tolerance deviations.
A spacing of 25mm between EGR pipes and engine- or chassis parts is recommended. Make sure during system installation that the EGR pipes occupy a neutral position before the brackets and clamps are tightened.

Note! The pipes are part of the inlet system and therefore high cleanliness requirements are needed. No weld fleas, metal chip, dust or other loose particulates that can damage the engine are allowed in the pipes.

4.4 Noise reduction

The particulate filter (DPF) will contribute to the total exhaust system noise reduction and typically replace the muffler in an existing configuration.

4.5 Vibrations and heat extension

To absorb possible vibrations and relative movement due to heat expansion, use of flexible parts are needed. In general a heat expansion of 1-2 mm /meter piping for every 100°C is a rule of thumb. Flexible parts also make the pipes easier to install.
Two types can be used: either a gastight annularly corrugated metal hose (figure 22) or a non gastight strip wound polygonal metal hose (figure 23). When tolerance deviation in the vessel is too large for the gastight metal hose and if movement of turning characteristic is needed for mounting, the non gastight metal hose can be used.

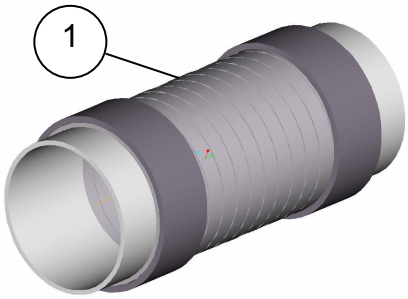


Figure 22. Flex pipe SSS-R.S.UO I.D49 (non gastight) with ends.

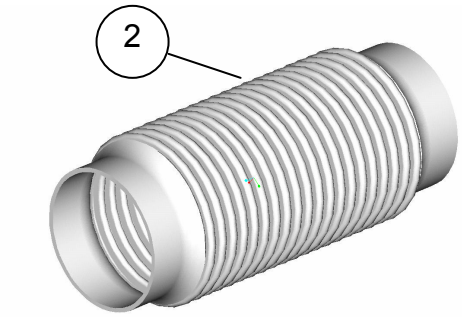


Figure 23. Flex pipe RS331S00 (gastight) with ends.

Pos	P/N	Description
1	101740	Flexpipe, non gastight, 150 mm
1	101741	Flexpipe, non gastight, 200 mm
2	100636	Flexpipe, gastight, 150 mm
2	100881	Flexpipe, gastight, 255 mm

4.6 Condensate and vapour

When cooled below condensation temperature the exhaust gas may form low concentrations of sulphuric and nitric acid. Low concentrations are not harmful but if the acid is trapped in the exhaust system it can enrich and become aggressive against the piping material. For this reason it is important that exhaust condensate is never trapped in the piping or the in-line components.
To enable a return flow of vapour in the EGR system, the layout of EGR pipes needs to drop from the EGR valve to the EGR pickup.
For applications where a drop all the way from the EGR valve to the dynamic pickup is impossible to achieve a condense removal solution needs to be included in the EGR loop.

An EGR Condensate Evacuator (ECE) can be used when continuous pipe sloping is not possible to achieve.

Pos	P/N	Description
1	102722	EGR condensate evacuator

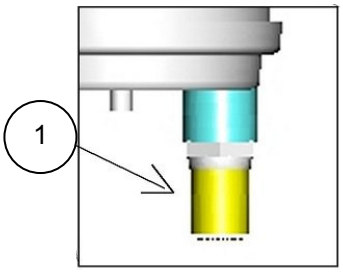


Figure 24. EGR Condensate Evacuator

Note! The discharge from the ECE outlet may contain hot exhaust and acid condensate and must be located in a position where it can not cause any personal injury or damage to components in the vehicle.

An EGR Condensate Evacuator (ECE) mounted at the lowest point in the EGR system allows condensate to drain from the EGR pipes. Any leak air from the outside will be filtered before it enters the EGR pipes. The leak though an ECE is very small and will not affect the EGR rate. Only one ECE per vehicle is allowed.

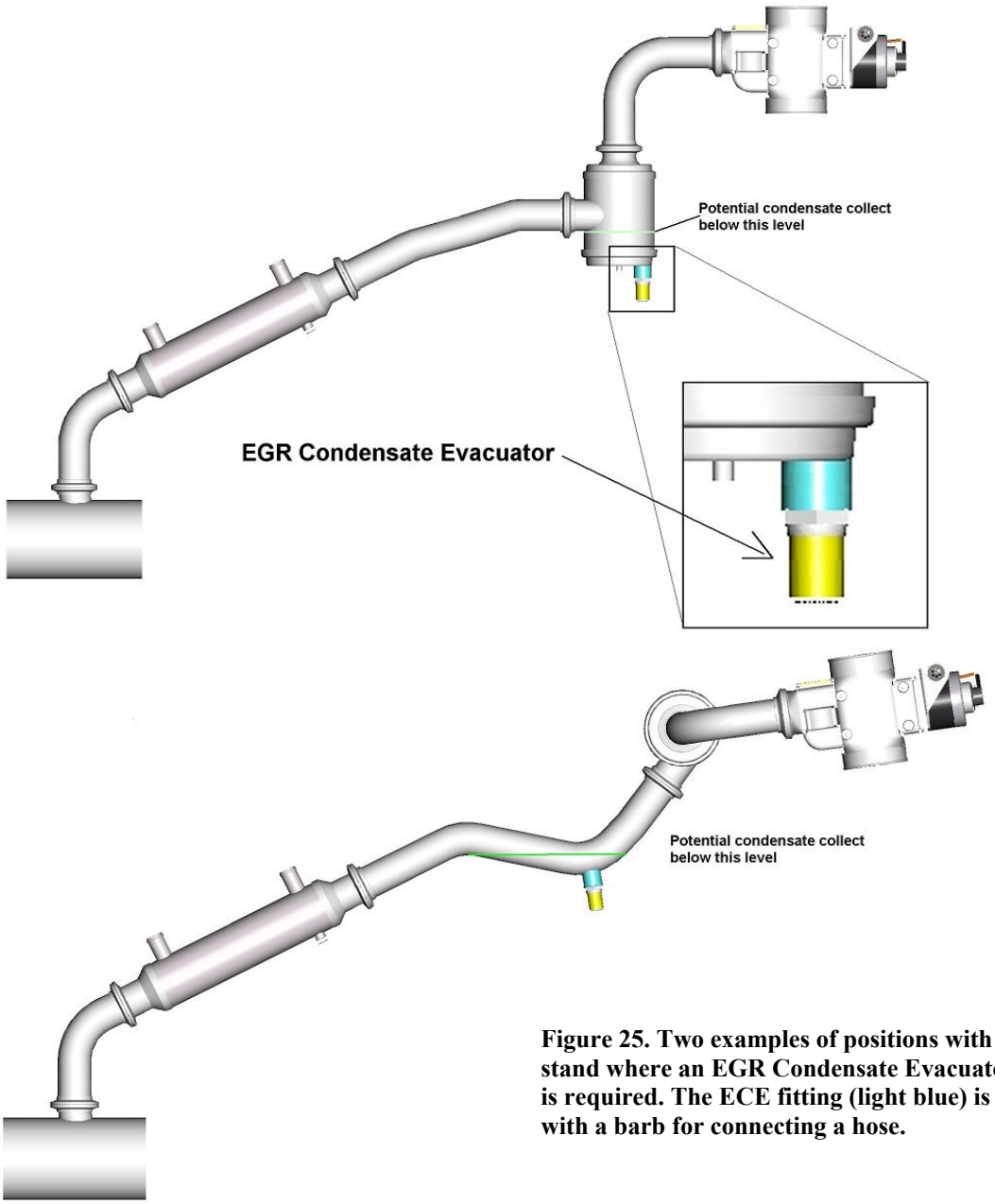


Figure 25. Two examples of positions with water stand where an EGR Condensate Evacuator (ECE) is required. The ECE fitting (light blue) is equipped with a barb for connecting a hose.

If the position where the ECE is connected can't be used for drainage due to reasons described above, a hose can be connected to the ECE fitting and routed to a suitable position. Note that the hose must enable condensate to flow all the way from the ECE to the outlet. No water stands are allowed in the hose.

Appendix 1 ..... **Electrical installation and reference diagrams**

Appendix 2 ..... **Mechanical installation and reference drawings**

Appendix 3 ..... **Service and maintenance**

Appendix 4 ..... **Technical specifications**

Appendix 5 ..... **Post installation adjustment and inspection**

Appendix 6 ..... **Trouble shooting guide**

See also CCT*marine* documentation

Appendix 1 wiring installation (230VAC)

System	**CCT*marine+DNOXmarine***	Proj #### Date	2014-08-26
Detail ref.	Leif Högberg		
Revision ref.	**APPENDIX 1**		
Vessel	**Template 230VAC**		

Table 1 Wire pinout

No	Label (from)	Wire type	Wire routing 1	2	3	4	5	6	7	8	9	10	Function
1	EBP	2x2x0.75	D1 *0V*	E1 *5V*	G4 *A4*								Pressure drop over DOC+DPF
2	PMP	1x2x0.75	C1 *VSS*	H6 *24S*									CCT fuel pump power supply
3	RUN	1x2x0.75	G19 *RN+*	G20 *RN-*									Engine running contact
4	CAN	2x2x0.75	C3 *VSS*		F6 *C1-*	F4 *C1+*							Engine J1939 CAN bus
5	HTR	1x2x0.75	B3 *24V*	H2 *O2*									CCT igniter power supply
6	THO	1x2x0.75	D2 *0V*	G5 *A5*									Temperature downstream igniter
7	MIT	1x2x0.75	D4 *0V*	G7 *A7*									Engine boost air temp
8	MAP	2x2x0.75	D3 *0V*	E2 *5V*	G3 *A3*								Engine boost pressure
9	RPM	1x2x0.75	D9 *0V*	G16 *D1*									Engine speed
10	EGR	2x2x0.75	C2 *VSS*	B1 *24V*	F5 *C1-*	F3 *C1+*							EGR valve control
11	TPS	2x2x0.75	D8 *0V*	E4 *5V*	G11 *A11*								Engine load
12	CWT	1x2x0.75	D7 *0V*	G10 *A10*									Engine coolant water temperature
13	START	1x2x0.75	B1 *24V*	G18 *D3*									Start switch
14	INJ	6x2x0.75	D10 *0V*	E5 *5V*	H1 *O1*	H3 *O3*	H4 *O4*	G1 *A1*	G2 *A2*	G6 *A6*	B2 *24V*	H5 *24S*	HC dosing unit
15	TDI	2x0.22/K	G12 *T1-*	G13 *T1+*									DOC inlet temperature
16	TDO	2x0.22/K	G14 *T2-*	G15 *T2+*									DOC outlet temperature
17	PWR	3G1.5	A1 *GND*	A2 *230V*	A3 *230V*								CCT supply voltage

Table 2 Wiring colours

Nr	1	2	3
2x0.22/K	White	Green	
3G1.5	Gn/ Yw	Blue	Brown

Table 3 Engine control Wiring

Pin	CC	Engine	Function	Location
CAN 1	B3	**IO1**	0V (from engine)	Engine control cabinet
CAN 2	-	-	-	-
CAN 3	F7	**IO2**	CAN LO	Engine control cabinet
CAN 4	F3	**IO3**	CAN HI	Engine control cabinet
RUN 1	G19	**IO4**	Engine running +	Engine control cabinet
RUN 2	G20	**IO5**	Engine running -	Engine control cabinet
-	H8	**IO6**	Alarm relay	Engine control cabinet
-	H9	**IO7**	Alarm relay	Engine control cabinet

Appendix 1 wiring installation (24VDC)

System	**CCT*marine*+*DNOXmarine***	Proj ####	Date 2014-08-26
Detail ref.	Leif Högberg		
Revision ref.	**APPENDIX 1**		
Vessel	**Template 24VDC**		

Table 1 Wire pinout

No	Label (from)	Wire type	Wire routing 1	2	3	4	5	6	7	8	9	10	Function
1	EBP	2x2x0.75	D1 *0V*	E1 *5V*	G4 *A4*								Pressure drop over DOC+DPF
2	PMP	1x2x0.75	C1 *VSS*	H6 *24S*									CCT fuel pump power supply
3	RUN	1x2x0.75	G19 *RN+*	G20 *RN-*									Engine running contact
4	CAN	2x2x0.75	C3 *VSS*		F6 *C1-*	F4 *C1+*							Engine J1939 CAN bus
5	HTR	1x2x0.75	B3 *24V*	H2 *O2*									CCT igniter power supply
6	THO	1x2x0.75	D2 *0V*	G5 *A5*									Temperature downstream igniter
7	MIT	1x2x0.75	D4 *0V*	G7 *A7*									Engine boost air temp
8	MAP	2x2x0.75	D3 *0V*	E2 *5V*	G3 *A3*								Engine boost pressure
9	RPM	1x2x0.75	D9 *0V*	G16 *D1*									Engine speed
10	EGR	2x2x0.75	C2 *VSS*	B1 *24V*	F5 *C1-*	F3 *C1+*							EGR valve control
11	TPS	2x2x0.75	D8 *0V*	E4 *5V*	G11 *A11*								Engine load
12	CWT	1x2x0.75	D7 *0V*	G10 *A10*									Engine coolant water temperature
13	START	1x2x0.75	B1 *24V*	G18 *D3*									Start switch
14	INJ	6x2x0.75	D10 *0V*	E5 *5V*	H1 *O1*	H3 *O3*	H4 *O4*	G1 *A1*	G2 *A2*	G6 *A6*	B2 *24V*	H5 *24S*	HC dosing unit
15	TDI	2x0.22/K	G12 *T1-*	G13 *T1+*									DOC inlet temperature
16	TDO	2x0.22/K	G14 *T2-*	G15 *T2+*									DOC outlet temperature
17	PWR	3G1.5	A1 *GND*	A2 *0V*	A3 *24V*								CCT supply voltage

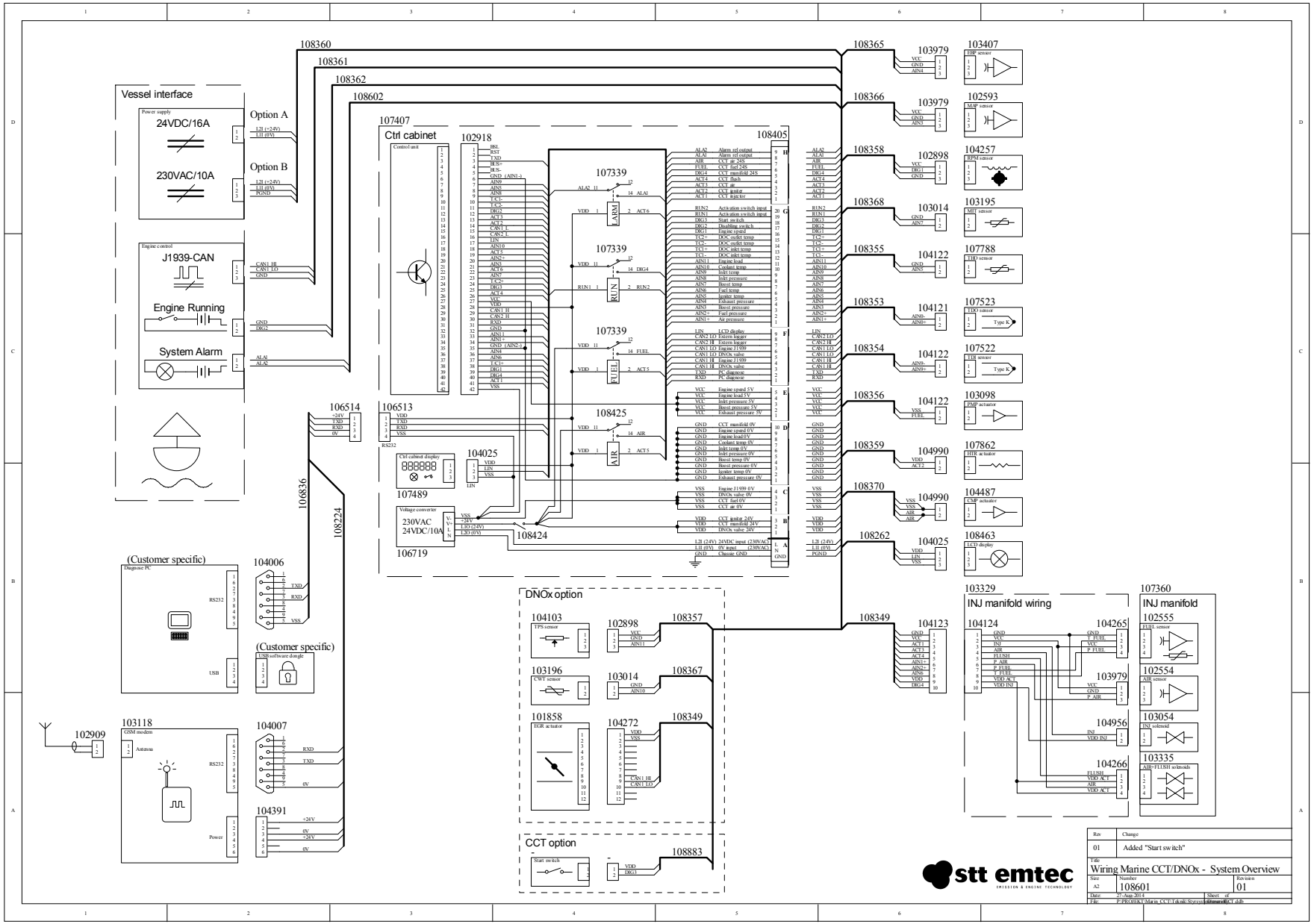
Table 2 Wiring colours

Nr	**1**	**2**	**3**
2x0.22/K	White	Green	
3G1.5	Gn/ Yw	Blue	Brown

Table 3 Engine control Wiring

Pin	CC	Engine	Function	Location
CAN 1	B3	**IO1**	0V (from engine)	Engine control cabinet
CAN 2	-	-	-	-
CAN 3	F7	**IO2**	CAN LO	Engine control cabinet
CAN 4	F3	**IO3**	CAN HI	Engine control cabinet
RUN 1	G19	**IO4**	Engine running +	Engine control cabinet
RUN 2	G20	**IO5**	Engine running -	Engine control cabinet
-	H8	**IO6**	Alarm relay	Engine control cabinet
-	H9	**IO7**	Alarm relay	Engine control cabinet

Appendix 1 Overview electrical schematic drawing



Rev	Change
01	Added "Start switch"

Title: Wiring Marine CCT/DNOx - System Overview
Size: A2 | Number: 108601 | Revision: 01
Date: 27-Aug-2014 | Sheet of
File: P:\PROJEKT\Marin_CCT\Teknik\Styrsystem\Elschema\ECT.ddb

STT Emtec AB (pbl)
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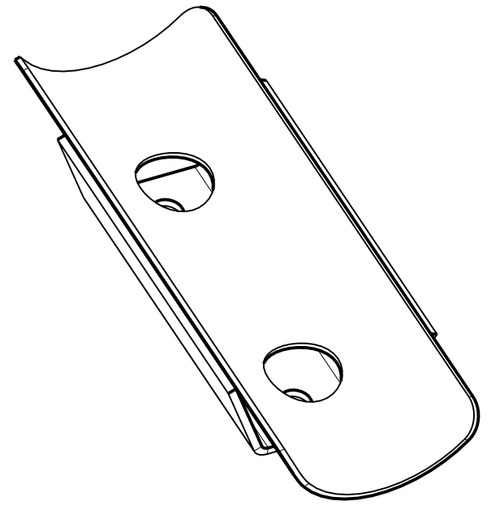
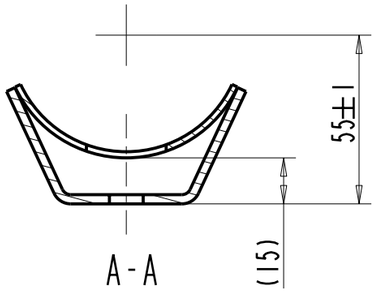
Internet: www.sttemtec.com

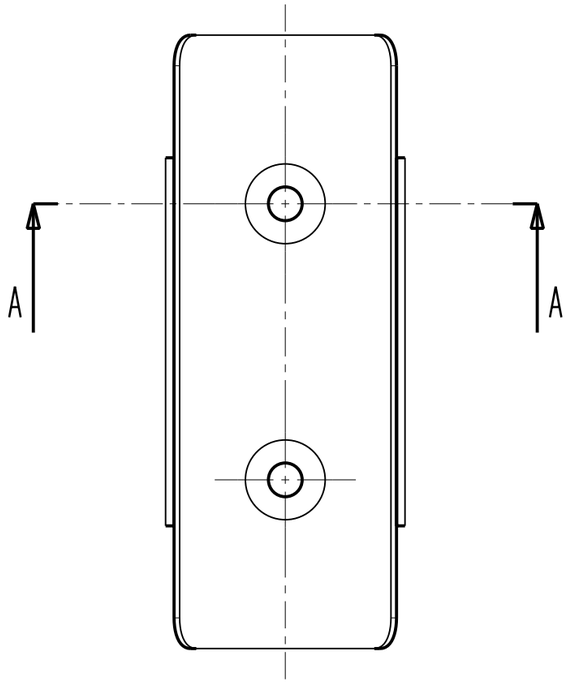
Head office: Sundsvall
Org.nr: 55 62 05 – 2927
VAT ID: SE556205292701
ISO-cetrifikat nr: 15627

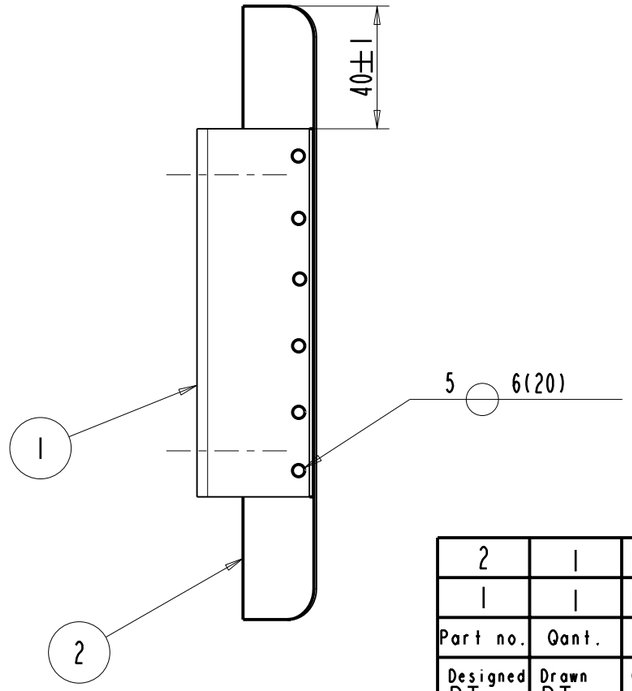
Appendix 2 Mechanical installation and reference drawings

No	Qua	Change note	Date	Inf.	Appr.





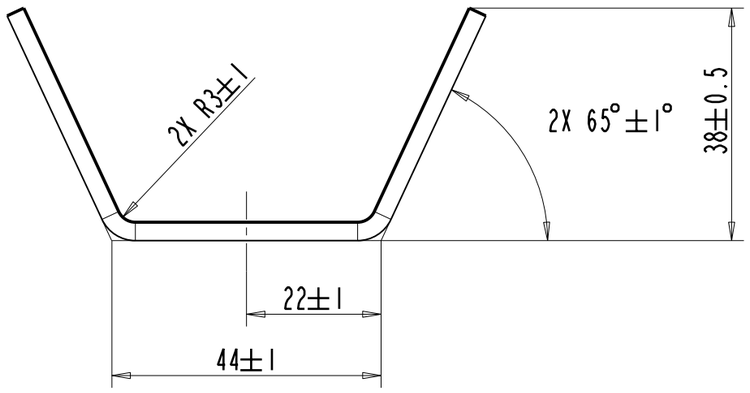


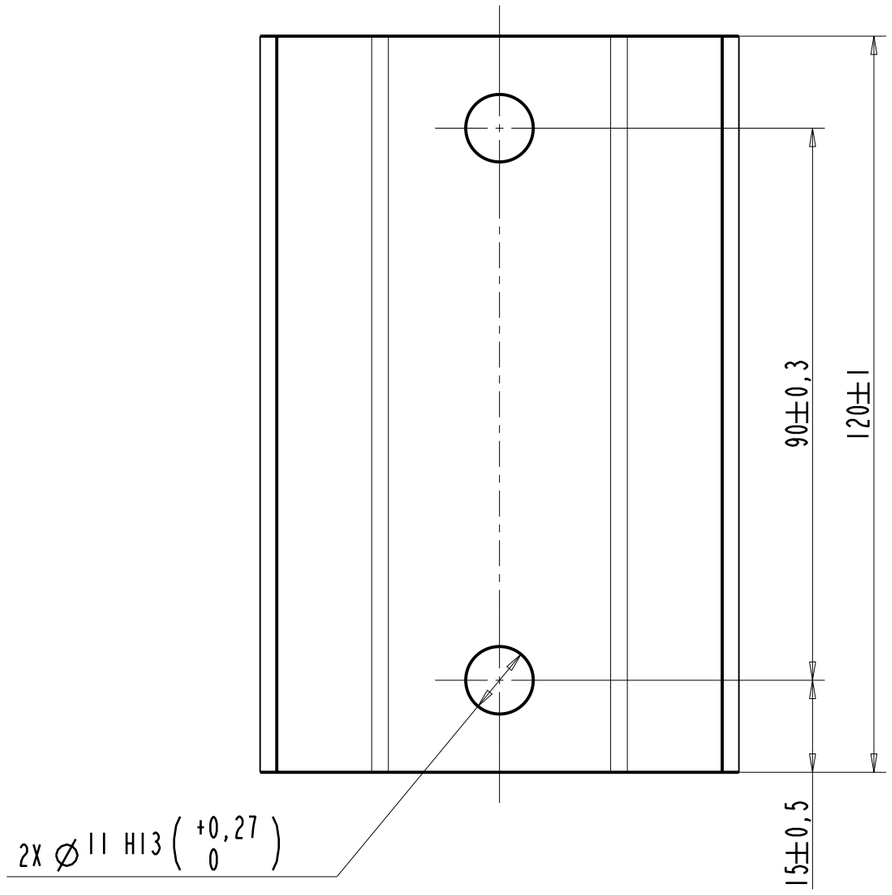


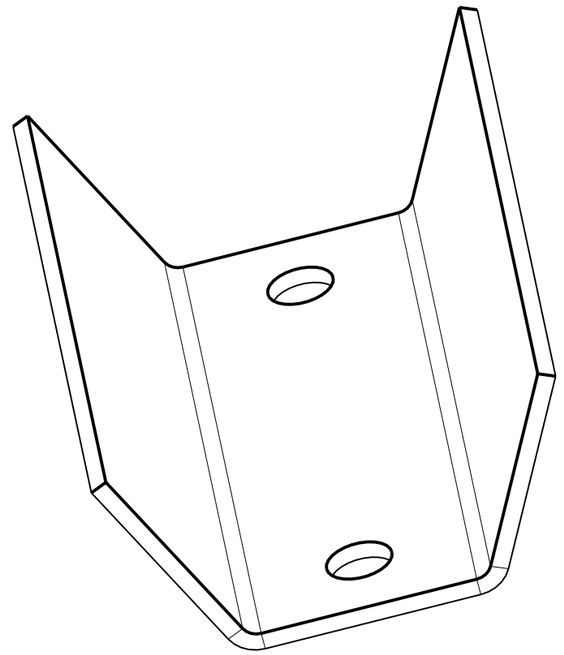
SURFACE TREATMENT: POWDERCOATING, BLACK

2	1	BRACKET, R38					DWG NO:399.3.4-0411	
1	1	BRACKET. 2X ∅11					DWG NO:399.3.3-0410	
Part no.	Qant.	Name			Material	Mod.nr blank Dimension	Note	
Designed PT	Drawn PT	Copy	Checked	Stand.	Appr.	Scale 1:2	Replace.	Replaced by
stt ENGINEERING		BRACKET, ASSY. EGR COOLER PART NO:313-30-1001.0					Filename	Date 00-10-03
							Dwg. no 399.1.3-0409	

No	Qua	Change note	Date	Inf.	Appr.



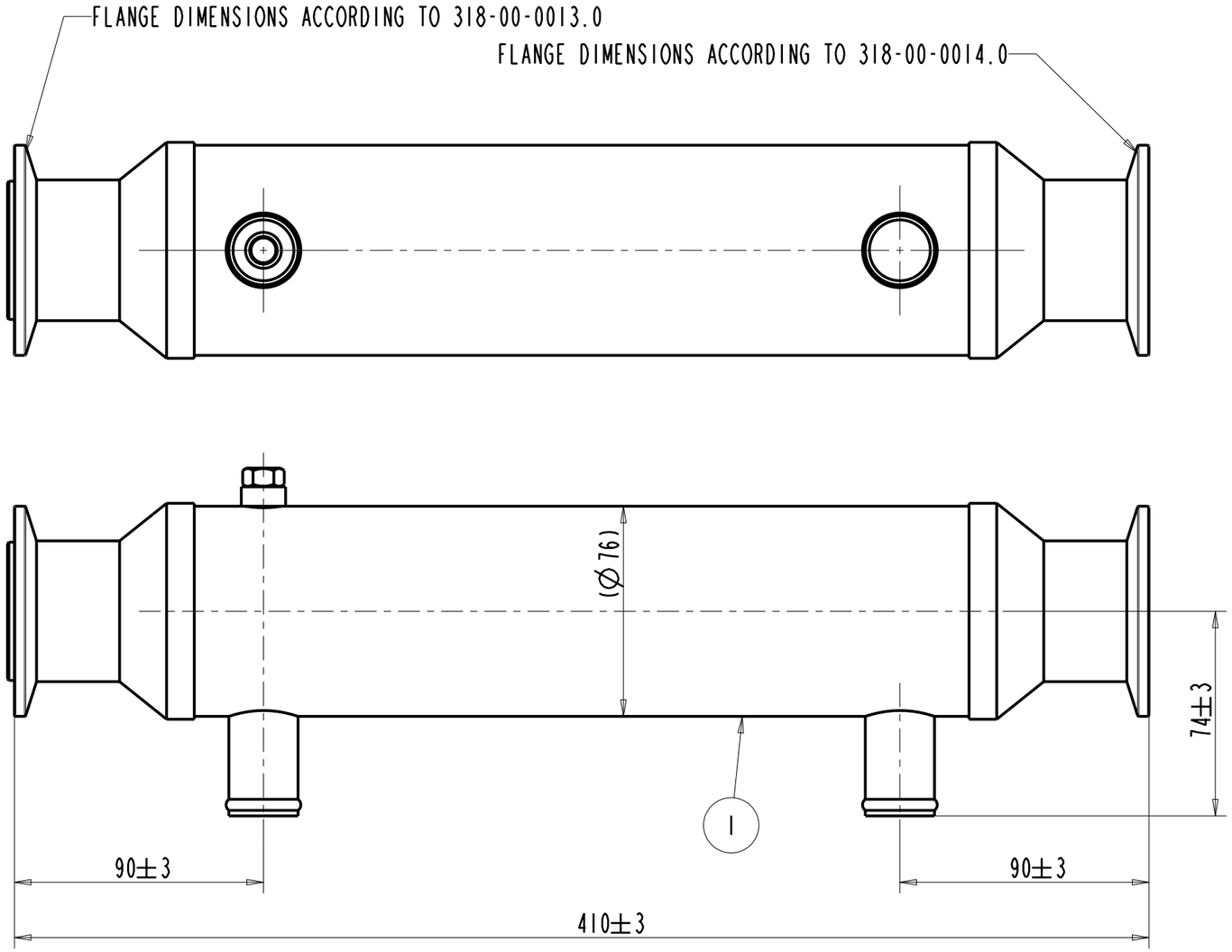


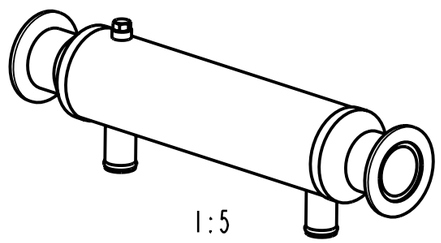


SHARP EDGES BROKEN

					SS1312	T=3±0.2		
Part no.	Qant.	Name			Material	Mod.nr blank Dimension	Note	
Designed PT	Drawn PT	Copy	Checked	Stand.	Appr.	Scale 1:1	Replace.	Replaced by
stt ENGINEERING		BRACKET, 2X Ø11 EGR COOLER PART NO:					Filename	Date 00-04-27
							Dwg. no 399.3.3-0410	

No	Loc.	Change note a:added, m:mod d:deleted	Date	Inf.	Appr.





TIGHTNESS REQUIREMENT: LEAKAGE TESTING ACC. TO

Medium	Air
Test pressure	300 kPa (3,0 bar) Min
Temperature	20°C±5°C
Leakage	0 mm^3/s Max

BURST TEST AND LEAKAGE TEST AFTER BURST TEST
ACC TO VALEO SPECIFICATION

Pos. no.	Qant.	Name	Material	Mod.nr blank Dimension	Note
		EGR COOLER	SS2333	-	VALEO 15757

Designed	Drawn	Copy	Checked	Stand.	Appr.	Scale	Replace.	Replaced by
MB	TJ					1:1		

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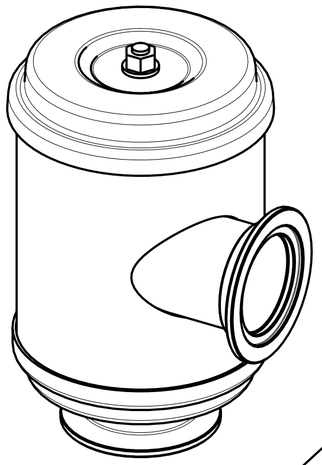
EMISSION & ENGINE TECHNOLOGY

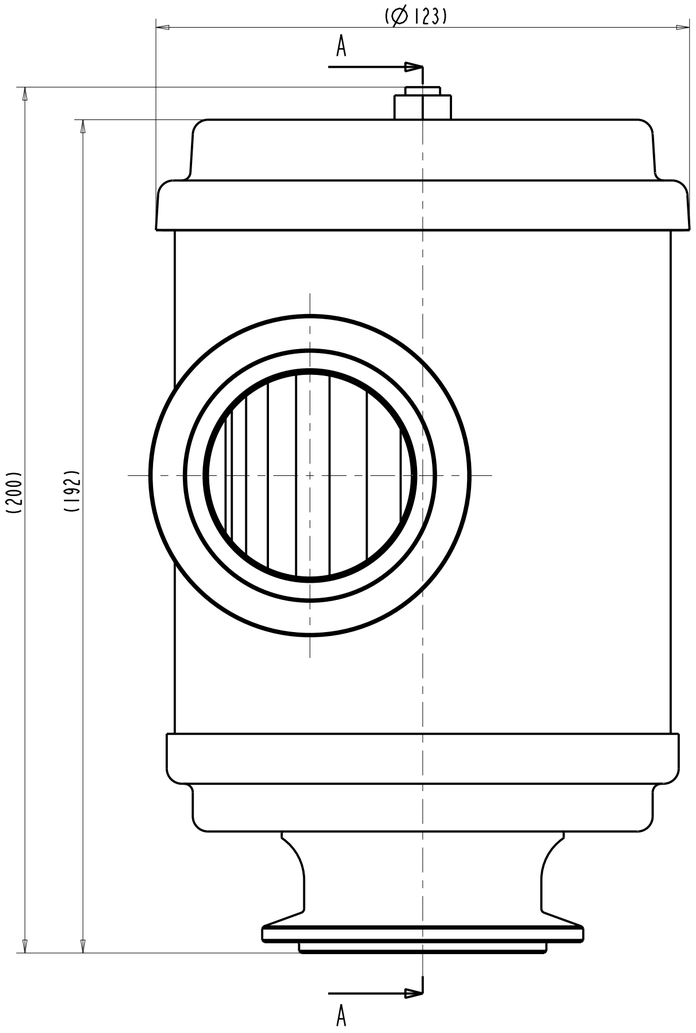
EGR COOLER
ASSY

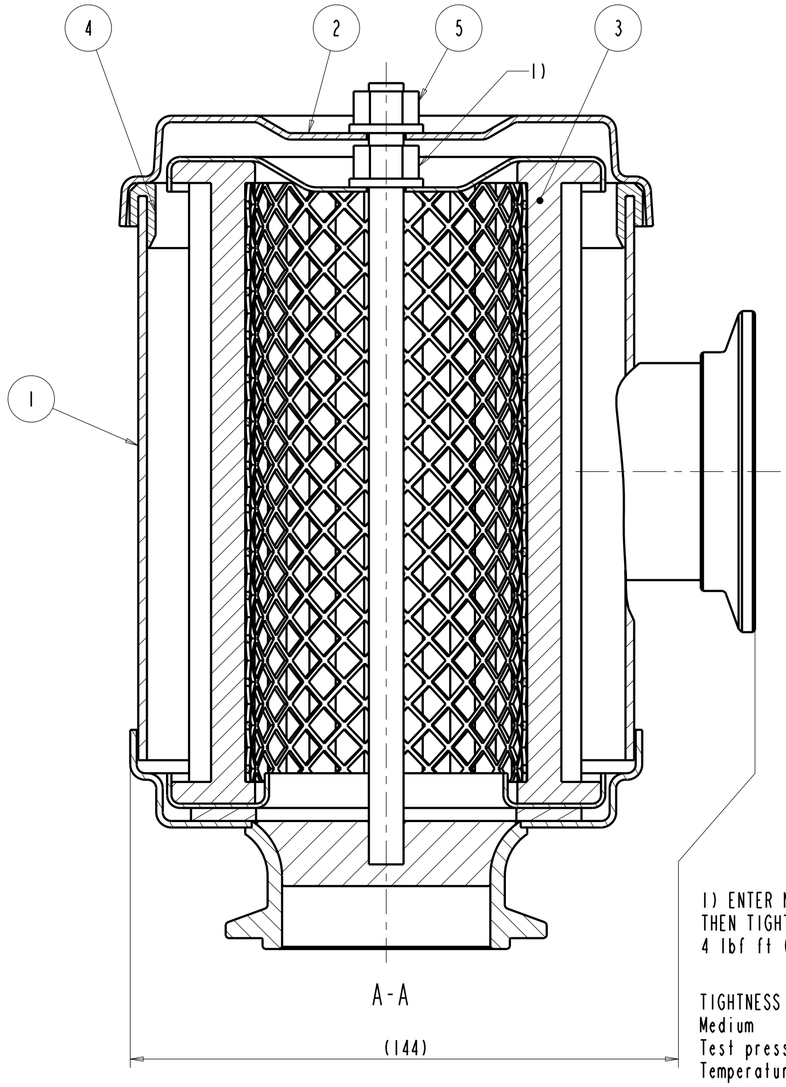
Filename	Date
	010919

Dwg. no	Rev.
100787	00

Rev.	Loc.	Change note a:added, m:mos d:deleted	Date	Sign.
02	posI	New drw 101347-02 w -01	030325	SB
03	H12	REV. d	040413	PT
04	H12	102528 w 100857	041221	PT
04	G11	0,5 rev (180°) w 1,5 rev (540°)	041221	PT
05	H12	103093 w 101236	050128	PT







1) ENTER NUT UNTIL IT TOUCHES FILTER,
THEN TIGHTEN APPROX. 0,5 REV (180°) =
4 lbf ft (5.5 Nm)

TIGHTNESS REQUIREMENTS: PRESSURE TESTING ACC. TO

Medium	Air
Test pressure	100 kpa (1,0 bar) Min
Temperature	20°C±5°C
Leakage	40mm³/s Max

Pos.	Qant.	Description	Material	Mod.nr blank Dimension	Part no.
5	2	NUT LOCK M8 980-W A2			100930
4	1	SEALING RING	FPM (VITON)		103093
3	1	FILTER			102528
2	1	GABLE	SS2333		101225
1	1	HOUSING	SS2333		101347

General tolerances for dimensions without tolerance indication according to ISO 2768 -m

Surface roughness Ra µm

Projection Method

Designed	Drawn	Copy	Checked	Stand.	Appr.	Scale
PT	PT		UE		UE	1:1

Replace. | Replaced by

Filename: EGR FILTER ASSY -

Date: 040413

Dwg. no: 101326

Rev: 05

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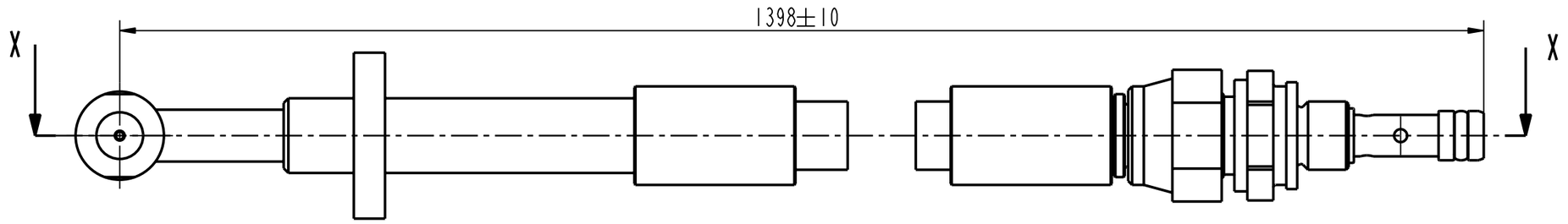
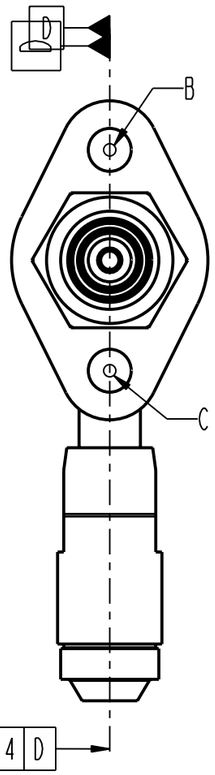
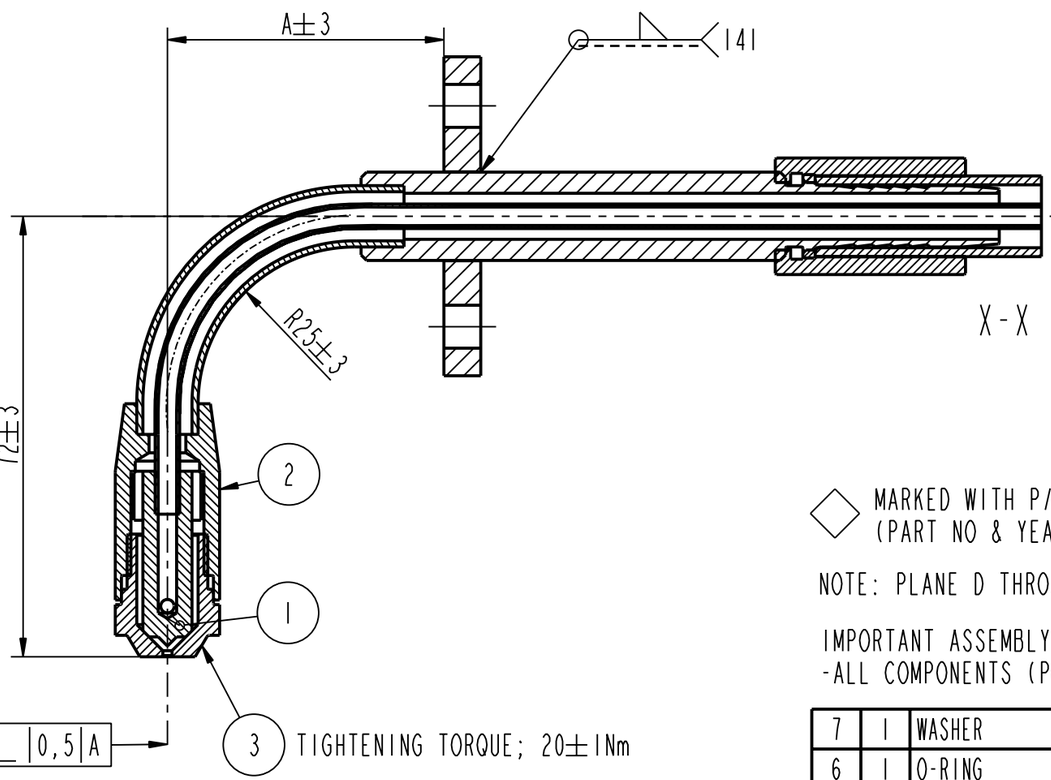
A2

Rev.	Loc.	Change note a=added, w=was d=deleted	Date	Sign.

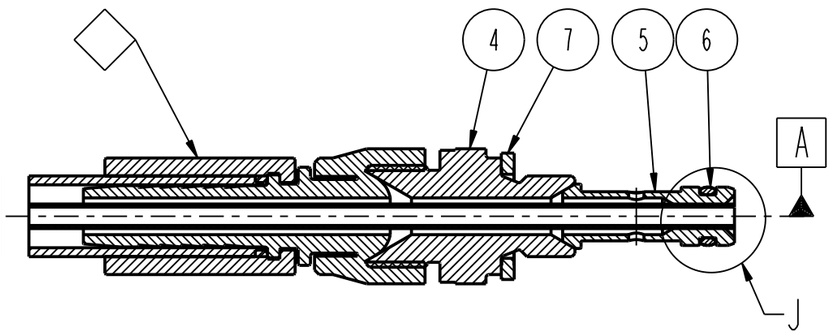


FLANGE ALIGNED
BEFORE WELDING

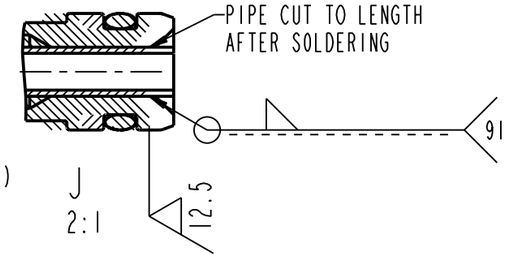




TIGHTENING TORQUE; 20±1Nm



X - X



◇ MARKED WITH P/N & YYYY WW D SSS
(PART NO & YEAR/WEEK/DAY/SERIAL NO)

NOTE: PLANE D THROUGH B AND C

IMPORTANT ASSEMBLY INFORMATION:
-ALL COMPONENTS (POS 1-7) PREASSEMBLED BEFORE BENDING

SIZE	A (mm)	STT NO.
3"	45	105572
3.5"	51	105574
4"	57	105575
4.5"	63	105576
5"	69	105577
5,5"	75	105307

Pos.	Qant.	Description	Material	Mod.nr blank Dimension	Part no.
7	1	WASHER	-	-	102270
6	1	O-RING	-	-	102283
5	1	PISTON	-	-	102259
4	1	ADAPTER 1/4 BSP- - 3/8 BSP	-	-	104176
3	1	NOZZLE CAP	-	-	102130
2	1	AIR SUPPLY, ASSY	-	-	105568
1	1	FUEL SUPPLY, ASSY	-	-	105566

General tolerances for dimensions without tolerance indication according to ISO 2768 -m

Surface roughness Ra µm

Projection Method

Designed	Drawn	Copy	Checked	Stand.	Appr.	Scale	Replace.	Replaced by
MT	SB		MT		UE	1:1		

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INJECTION NOZZLE L=1400

CCT

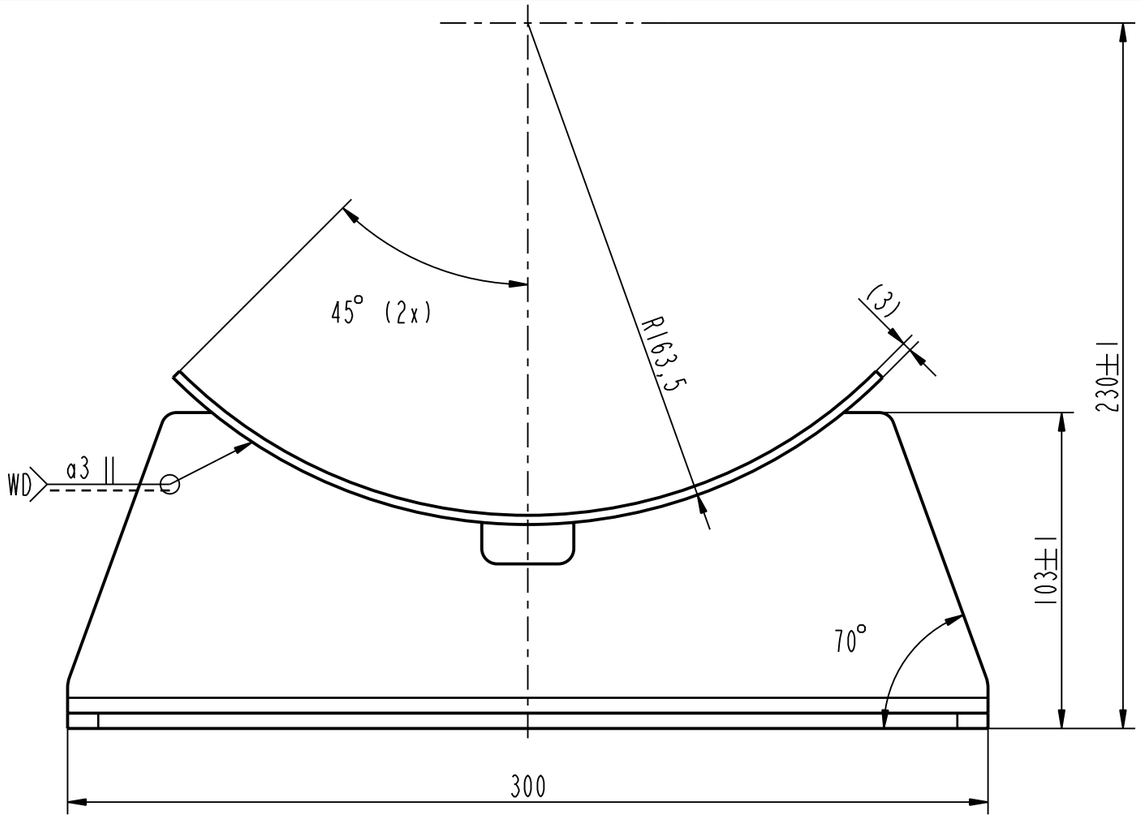
Filename	Date
	050624

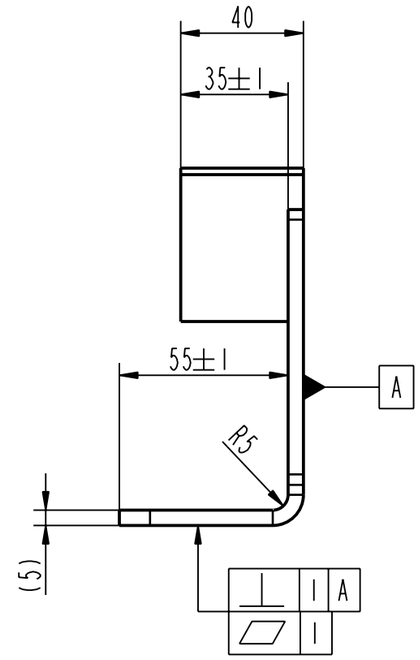
Dwg. no	Rev
105560	01

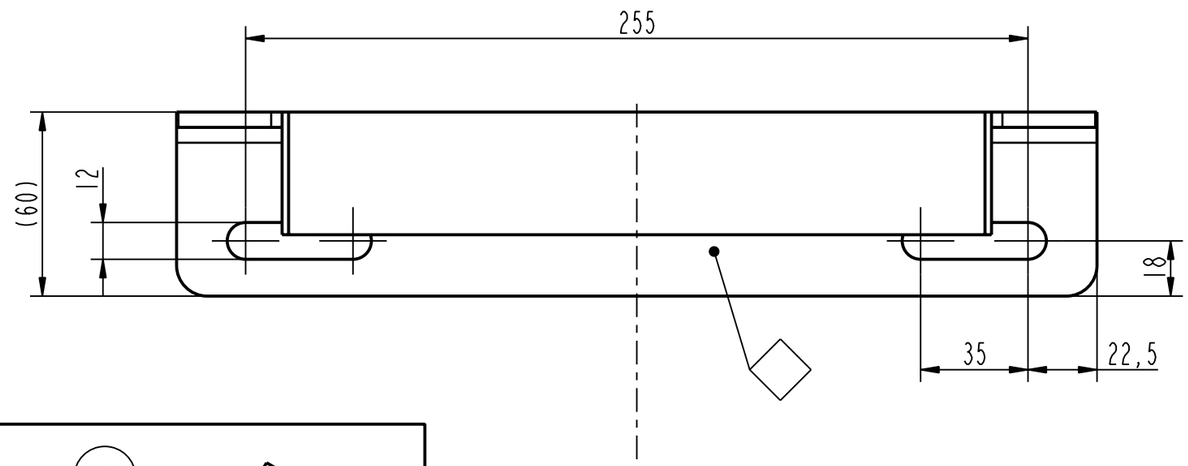
A3

Product No. Kit	Pos	Product No. Components	Description	Quantity	Sign.
105560-01	00	OP1003	Assembly	5	
	01	105566-00	Fuel Supply, Assy	1	
	02	105568-00	Air Supply, Assy	1	
	03	102130-05	Nozzle Cap	1	
	04	104176-03	Adapter 1/4BSP--3/8BSP SS2333	1	
	05	102259-07	Piston	1	
	06	102283	O-ring, 6x2 (Viton)	1	
	07	102270	Washer R1/4", Tredo 14	1	

Rev.	Loc.	Change note a=added, w=was d=deleted	Date	Sign.
02		Narrowed Flatbar	090902	DZ



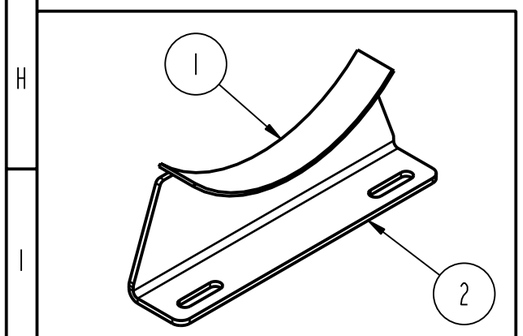




◇ MARKED WITH PART NO: 105602

TOLERANCE UNLESS OTHERWISE STATED ±0.5

FREE FROM BURRS, SHARP EDGES BROKEN



Pos.	Qant.	Description	Material	Mod.nr blank Dimension	Part no.
2	1	PLATE	EN 1.4301	T=5	
1	1	FLAT BAR	EN 1.4301	40x3	

General tolerances for dimensions without tolerance indication according to ISO 2768 -m	Surface roughness Ra µm	Projection Method

Designed	Drawn	Copy	Checked	Stand.	Appr.	Scale	Replace.	Replaced by
SB	SB					1:2		

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BRACKET OUTLET
DPF EQ

Filename	Date
	071012

Dwg. no	Rev
105602	02

A3

Rev.	Loc.	Change note a=added, w=was d=deleted	Date	Sign.
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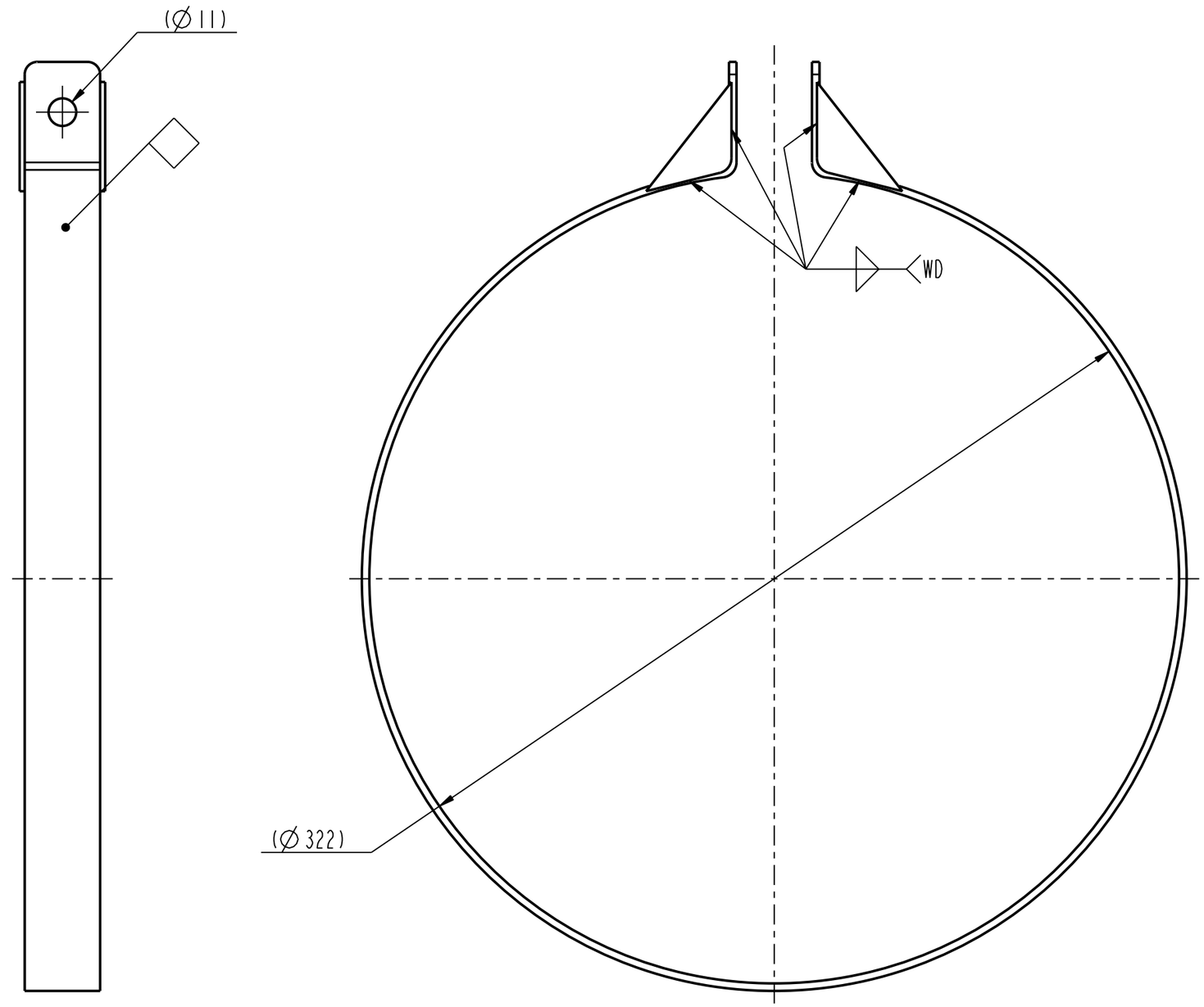
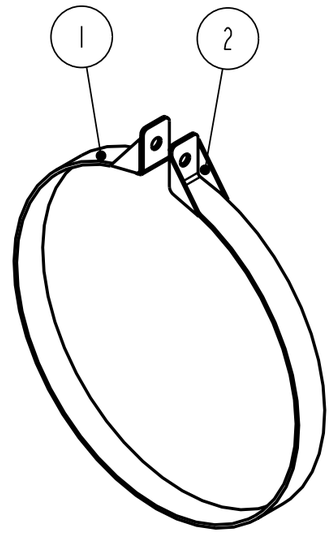




◇ MARKED WITH PART NO: 105603

Pos.	Qant.	Description	Material	Mod.nr blank Dimension	Part no.

General tolerances for dimensions without tolerance indication according to ISO 2768 -m	Surface roughness Ra µm	Projection Method

Designed	Drawn	Copy	Checked	Stand.	Appr.	Scale	Replace.	Replaced by
SB	SB		UE		UE	1:2		

stt emtec

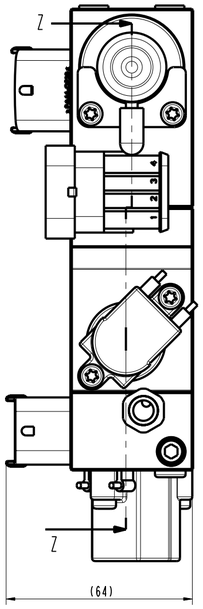
CLAMP ASSY ∅ 322
DPF EQ

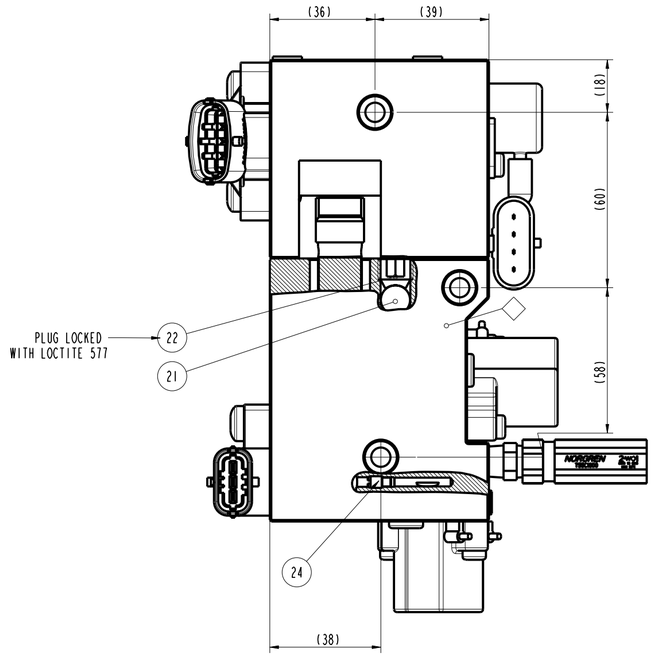
Filename	Date
	071012

Dwg. no	Rev
105603	01

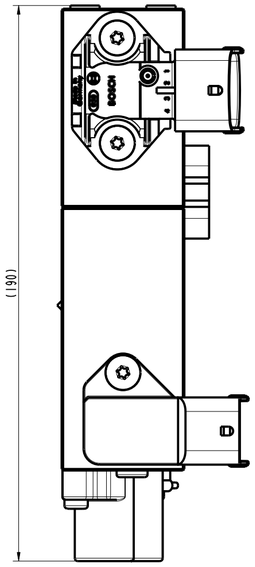
A3

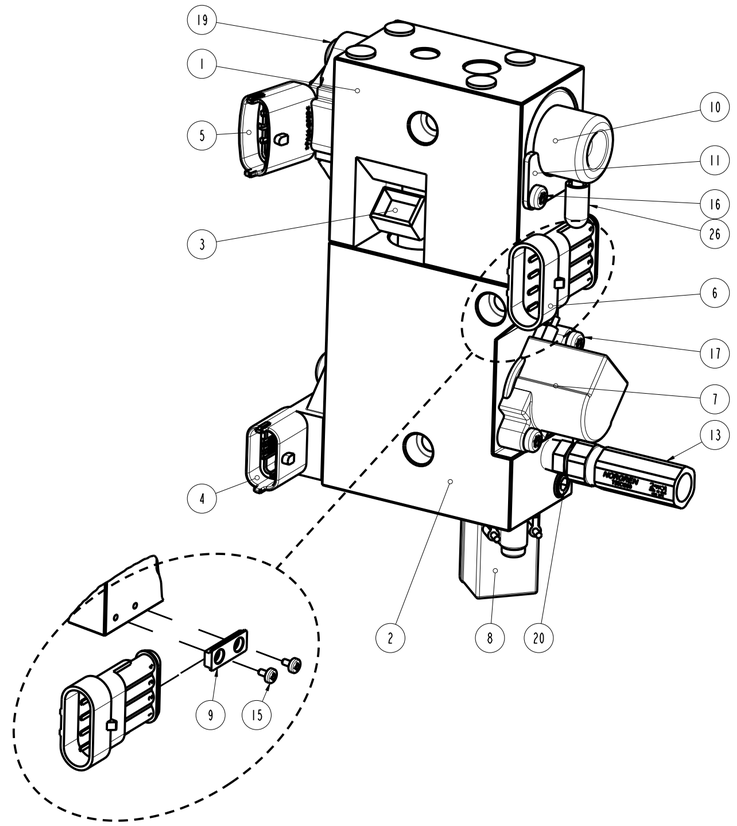
Rev.	Loc.	Change note	Date	Sign.
		modified, where deleted		

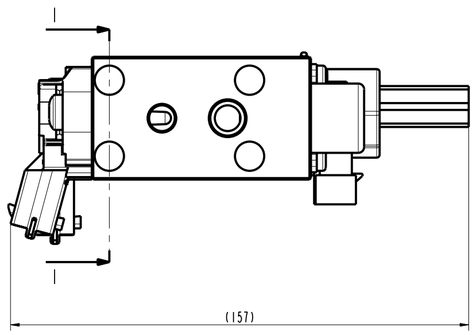


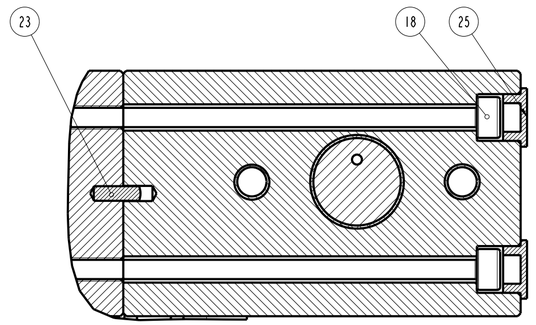


Z-Z

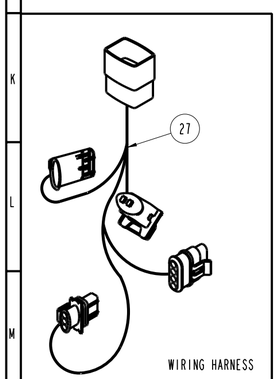








I - I
2:1



Pos.	Qant.	Description	Material	Mod.nr blank Dimension	Part no.
27	1	WIRING HARNESS	-	-	103329
26	1	CAP, RUBBER	-	-	104416
25	4	PLUG, PLASTIC	-	-	103263
24	1	JET 090	-	-	103190
23	2	PARALLEL PIN	-	-	102339
22	1	SCREW SK6SS M12x1,75 L:10	-	-	104903
21	1	BALL ∅ 10	-	-	104902
20	1	PLUG R1/8 BSP w SEALING	-	-	105531
19	3	SCREW MRT M6x20	-	-	104981
18	4	SCREW MC6S M4x70	-	-	102179
17	4	SCREW MRT M4x20	-	-	104982
16	2	SCREW MRT M4x10	-	-	104983
15	2	SCREW MRT 2.5x4	-	-	105512
13	1	FLOW CONTROL VALVE, ASSY	-	-	105752
11	1	BRACKET	-	-	102190
10	1	FUEL PRESSURE REGULATOR	-	-	103290
9	1	BRACKET	-	-	103321
8	1	SOLENOID VALVE 3/2 INSERT VSD1	-	-	103661
7	1	SOLENOID VALVE 2/2 INSERT VSD2	-	-	103660
6	1	SOLENOID VALVES	-	-	103335
5	1	PRESSURE SENSOR, FUEL	-	-	102555
4	1	PRESSURE SENSOR, AIR	-	-	102554
3	1	INJECTOR	-	-	103054
2	1	MANIFOLD	-	-	102168
1	1	MANIFOLD	-	-	102170

◇ MARKED WITH YEAR/WEEK/DAY/SERIAL NO
YYYY WW D SSS

General tolerances for dimensions without tolerance indication according to ISO 2768 -m

Surface roughness Ra µm

Projection Method

Designed	Drawn	Copy	Checked	Stand.	Appr.	Scale
MT	SB		MT		-	1:1

Replace. | Replaced by

stt emtec

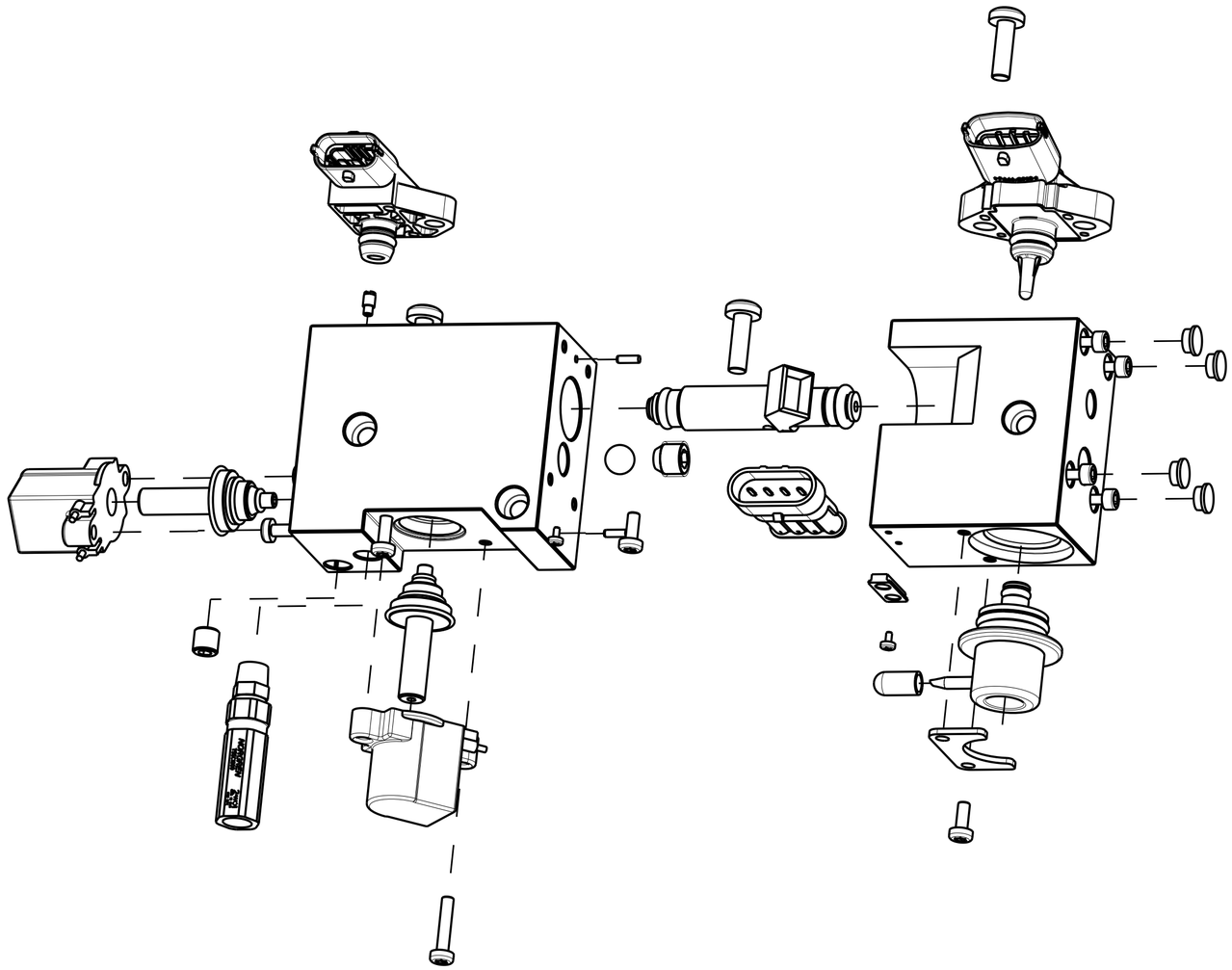
INJECTION MANIFOLD 24V MASTER, ASSY
CCT

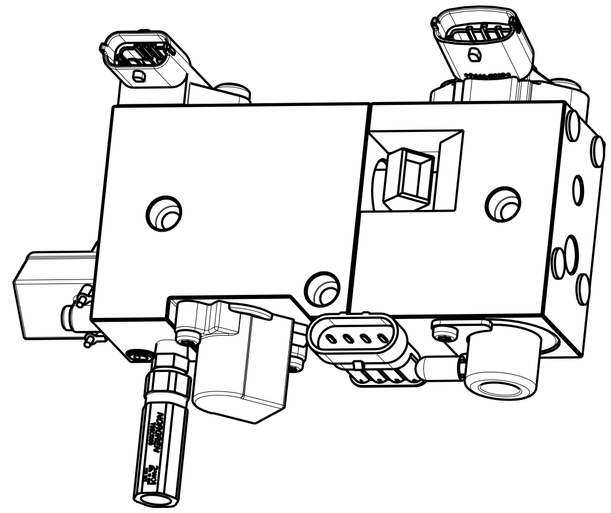
Filename | Date 080414

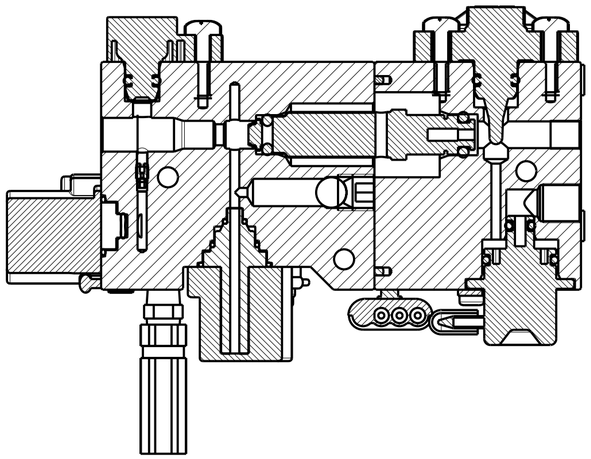
Dwg. no 105842 | Rev 00

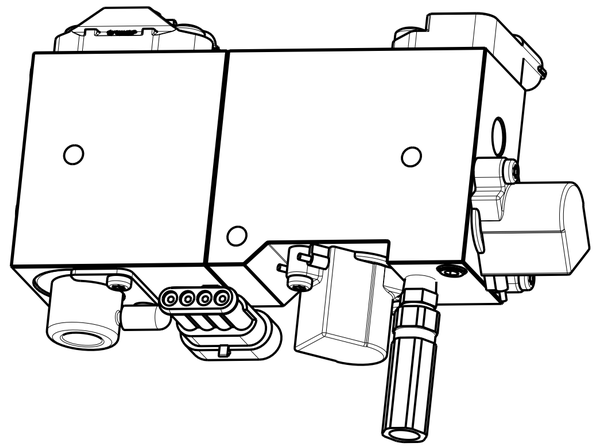
A1

Rev.	Loc.	Change note a=added, m=mos d=deleted	Date	Sign.









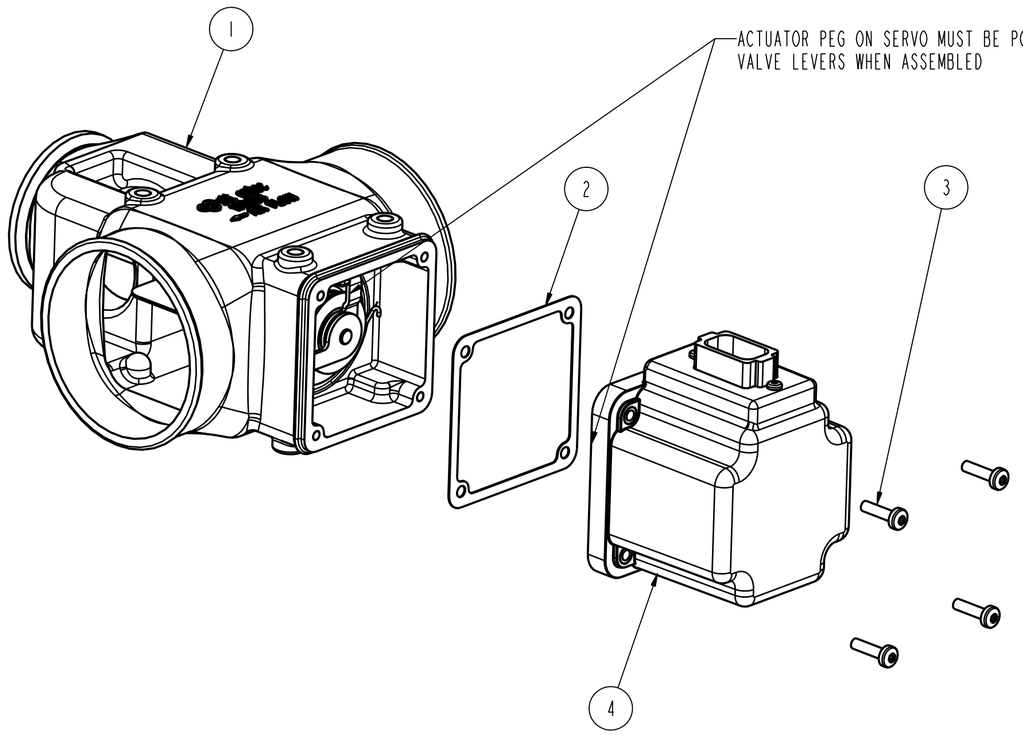
Pos.	Qant.	Description	Material	Mod.nr blank Dimension	Part no.
General tolerances for dimensions without tolerance indication according to ISO 2768 -m			Surface roughness Ra µm	Projection Method	
Designed MT	Drawn SB	Copy	Checked -	Stand.	Appr. -
			Replace.	Replaced by	
			Filename	Date 080414	
			Dwg. no 105842	Rev 00	

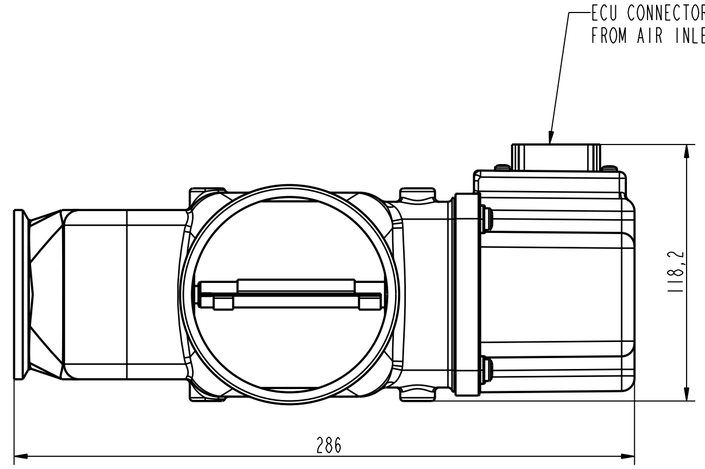
stt emtec

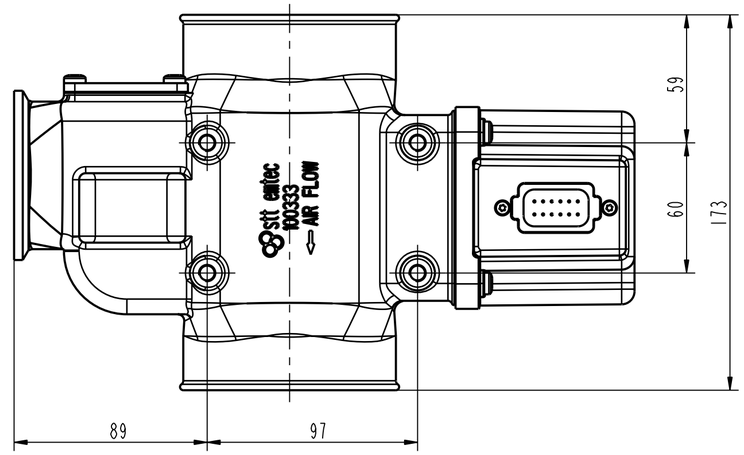
INJECTION MANIFOLD 24V MASTER, ASSY

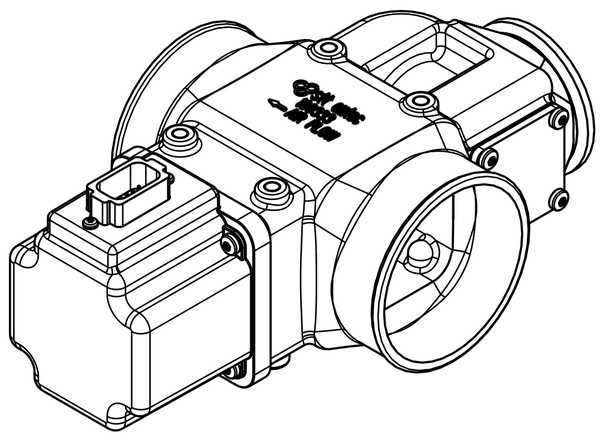
CCT

Rev.	Loc.	Change note a:added, m:mos d:deleted	Date	Sign.









Pos.	Qant.	Description	Material	Mod.nr blank Dimension	Part no.
4	1	SERVO DNOx	-	-	101858
3	4	SCREW M5x20 MRT	-	-	100870
2	1	GASKET, STEPPER MOTOR	-	-	102136
1	1	EGR VALVE	-	-	103079

General tolerances for dimensions without tolerance indication according to ISO 2768 -m

Surface roughness Ra µm

Projection Method

Designed	Drawn	Copy	Checked	Stand.	Appr.	Scale	Replace.	Replaced by
LM	UE		UE		UE	1:2		

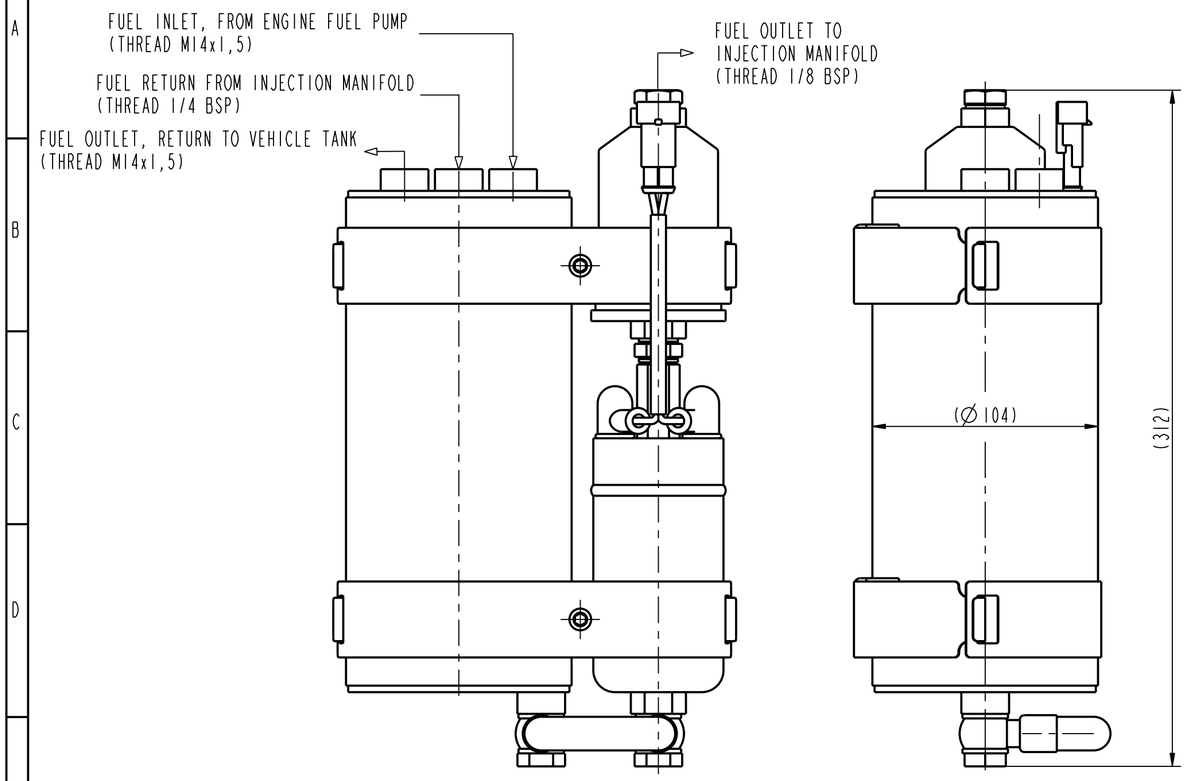
stt emtec

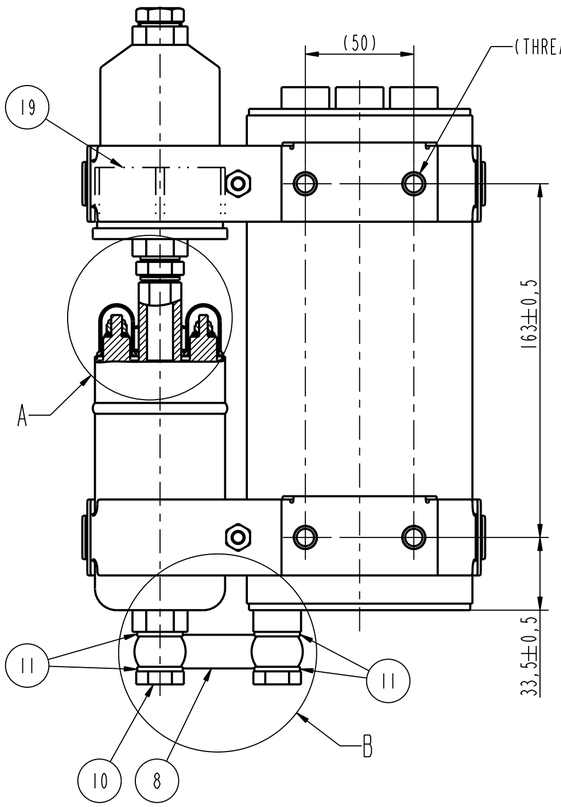
EGR Valve Assy, 4"
Volvo Penta D5 102kW

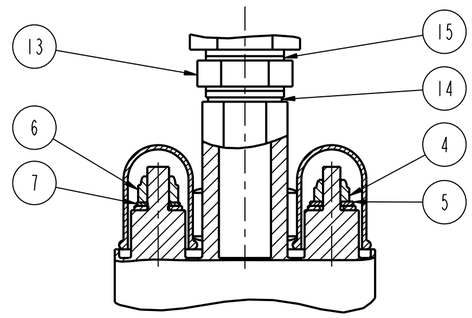
Filename	Date
	121108

Dwg. no	Rev
107374	00

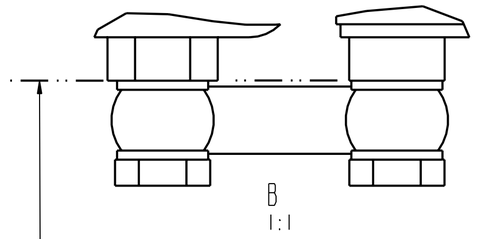
Rev.	Loc.	Change note a:added, m:mos d:deleted	Date	Sign.





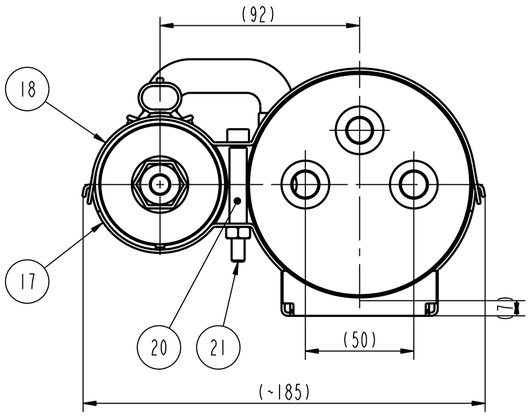


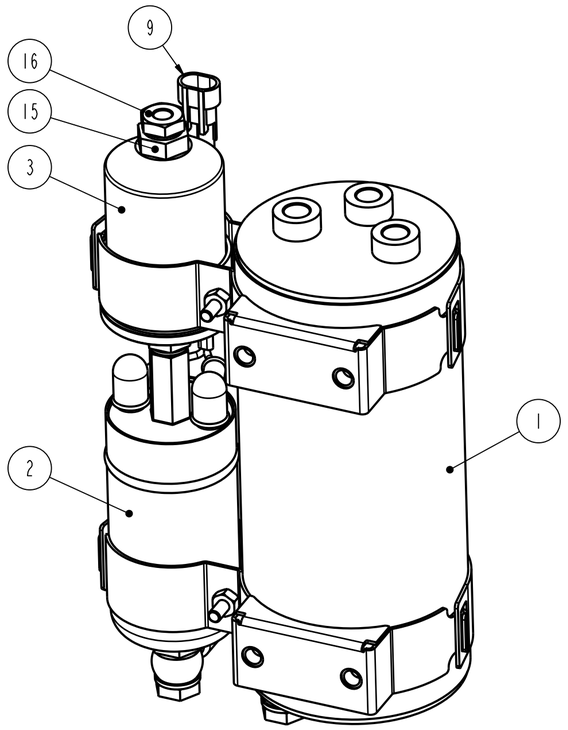
A
1:1



B
1:1

POS 1 AND 2 TO BE IN LINE
BEFORE MOUNTING HOSE, POS 8





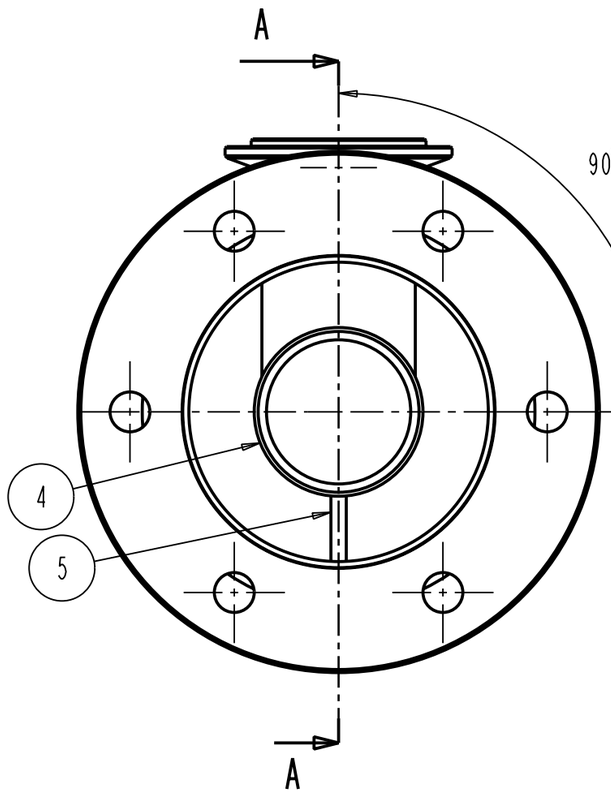
Pos.	Qant.	Description	Material	Mod.nr blank Dimension	Part no.
General tolerances for dimensions without tolerance indication according to ISO 2768 -m			Surface roughness Ra µm	Projection Method	
Designed MT	Drawn SB	Copy	Checked UE	Stand.	Appr. UE	Scale 1:2	Replace.	Replaced by
							Filename	Date 110525
							Dwg. no 108025	Rev 00

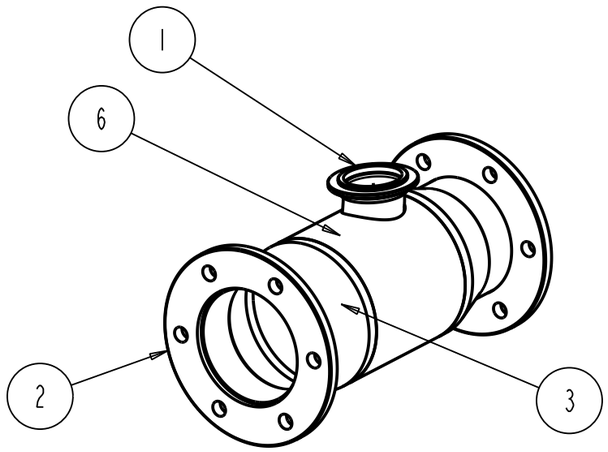
stt emtec

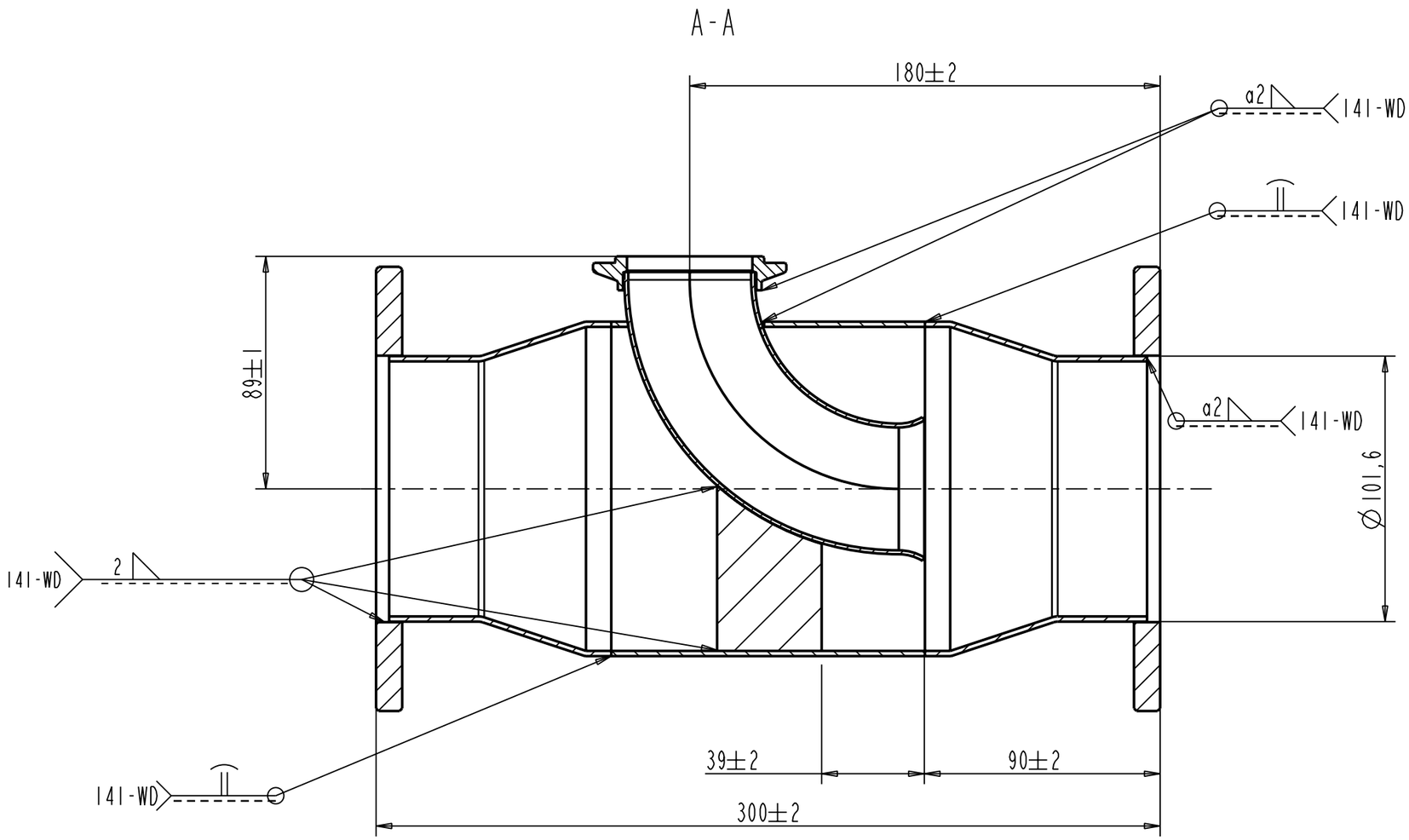
FUEL CATCH TANK, ASSY
CCT / LEAN NOx

Product No. Kit	Pos	Product No. Components	Description	Quantity	Sign.
108025-00	00	OP1003	Assembly	60	
	01	106577-00	Fuel Catch Tank, 1.75 litre	1	
	02	103098	Fuel Pump Diesel, 24V, 280l/h	1	
	03	102584	Fuel Filter, 0.2l	1	
	04	480-00-0312.0	Nut Lock M4 Polyamid Insert	1	
	05	480-00-0709.0	Washer Flat M4	1	
	06	480-00-0224.0	Nut M5 Lock Polyamid Insert	1	
	07	480-00-0020.0	Washer Flat 4,8x10x0,8 fzb	1	
	08	106578-01	Fuel Supply Hose	1	
	09	103623-00	Wiring Harness, Catch Tank	1	
	10	102614	Screw Hollow M14x1.5 C4	2	
	11	102384	Washer M14, Tredo 114	4	
	13	102585	Adapter nipple M12--M14 (out)	1	
	14	102934	Washer Cu 12x18x1.5	1	
	15	480-00-0288.0	Washer Cu M14x18x1.5	2	
	16	106297-01	Adapter, Utv M14 -> inv1/8 BSP	1	
	17	106348-02	Clamp	2	
	18	106349-02	Clamp	2	
	19	108053-00	Sleeve	1	
	20	106580-00	Pipe	2	
	21	106581	Screw MC6S 6x55 A4-70	2	
	25	107595	Plug M14x1,5	2	
	26	105200	Plug, Plastic, Ø11,4--Ø12,8	1	

Rev.	Loc.	Change note a=added, w=was d=deleted	Date	Sign.
01	C7	89 w 86; 180 w 181,5	20140715	LM







FREE FROM BURRS

Pos.	Qant.	Description	Material	Mod.nr blank Dimension	Part no.

General tolerances for dimensions without tolerance indication according to ISO 2768 -m	Surface roughness Ra µm	Projection Method

Designed	Drawn	Copy	Checked	Stand.	Appr	Scale	Replace.	Replaced by
LM	LM					1:2		

stt emtec

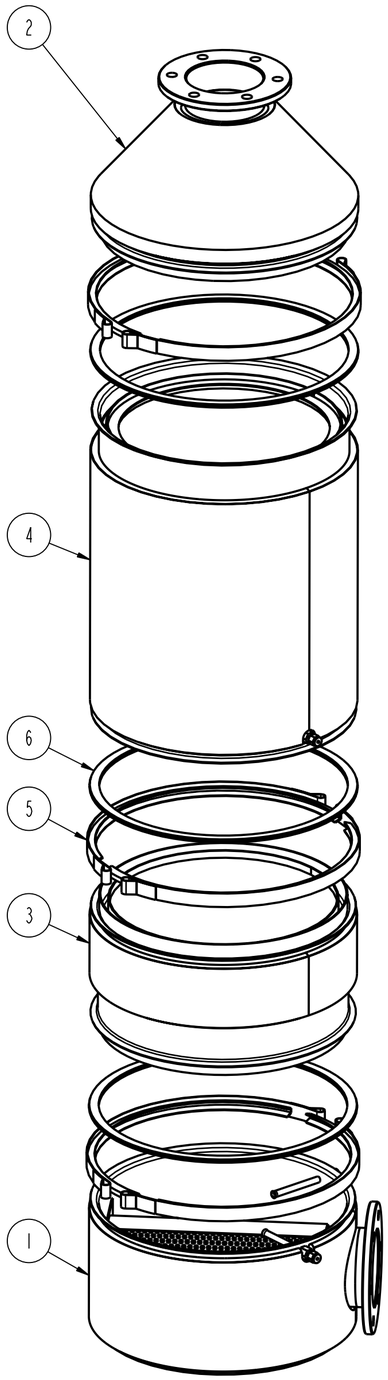
DYNAMIC PICKUP ASSEMBLY

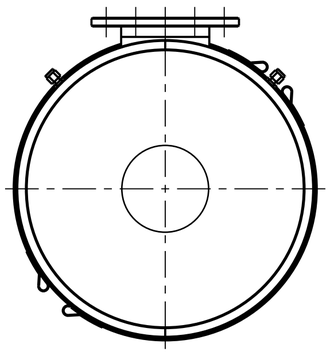
Filename	Date
	130211

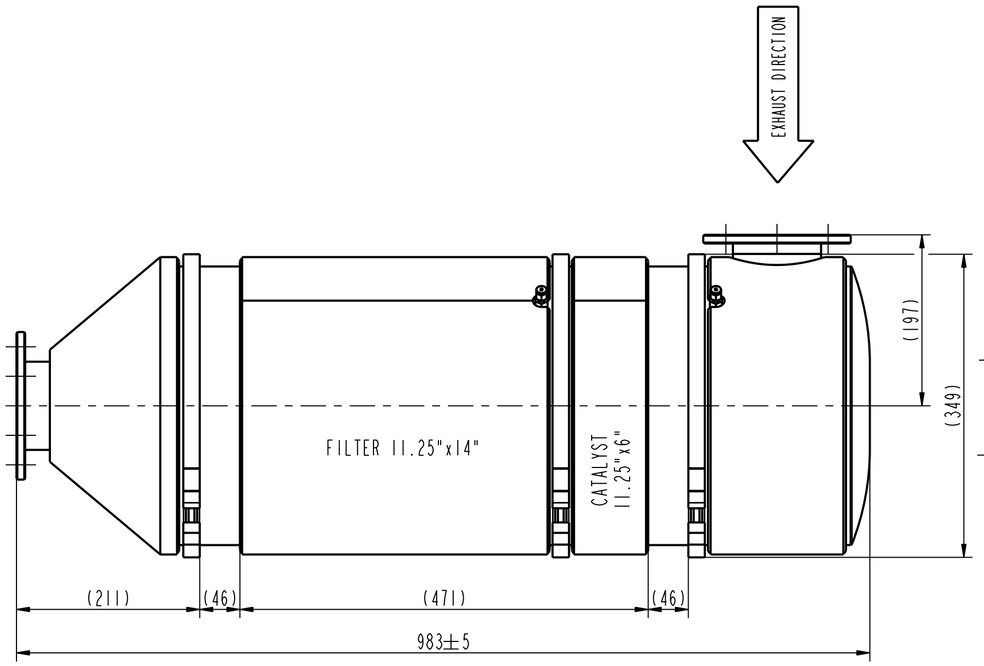
Dwg. no	Rev
108436	01

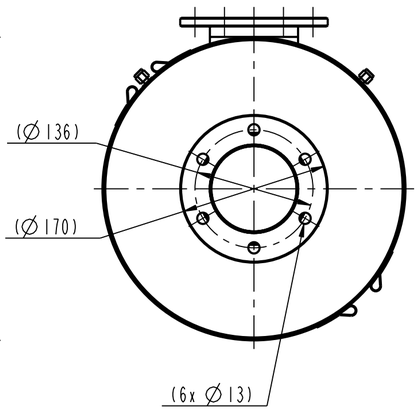
A3

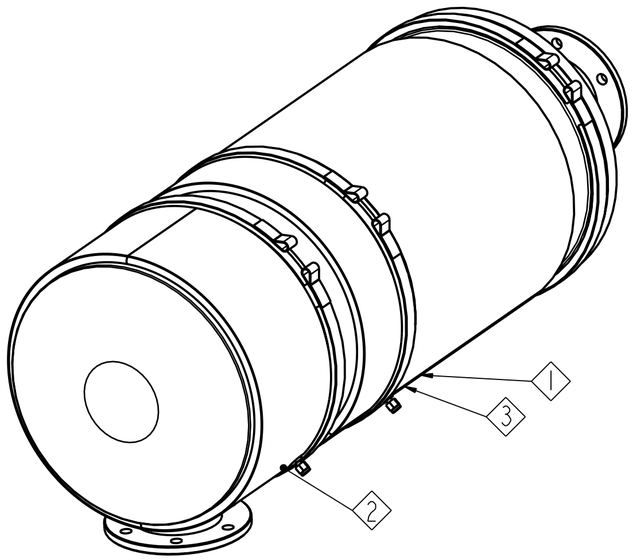
Rev.	Loc.	Change note a:added, m:mos d:deleted	Date	Sign.











1 MARKED WITH: PART NO 108437-00

2 MARKED WITH: T_HTR (T_DOC_1 FOR DPF WITHOUT IGNITER)

3 MARKED WITH: T_DOC_0

Pos.	Qant.	Description	Material	Mod.nr blank Dimension	Part no.
General tolerances for dimensions without tolerance indication according to ISO 2768 -m			Surface roughness Ra µm	Projection Method	
Designed LM	Drawn UE	Copy	Checked	Stand.	Appr.	Scale 1:5	Replace.	Replaced by
							Filename	Date 120629
							Dwg. no 108437	Rev 00

stt emtec

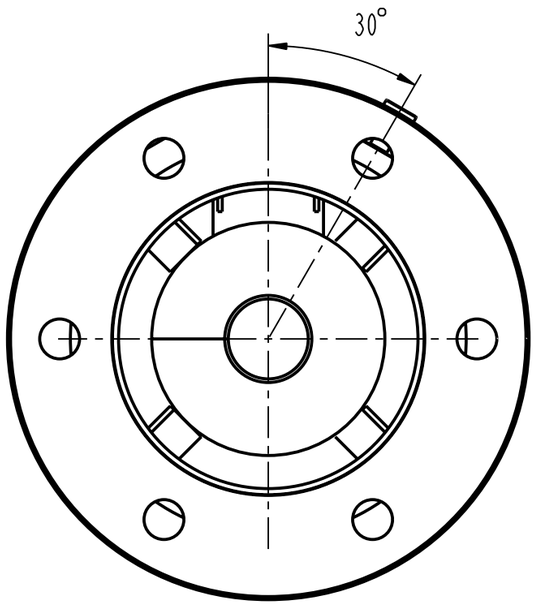
DPF ASSY 11,25" Coated

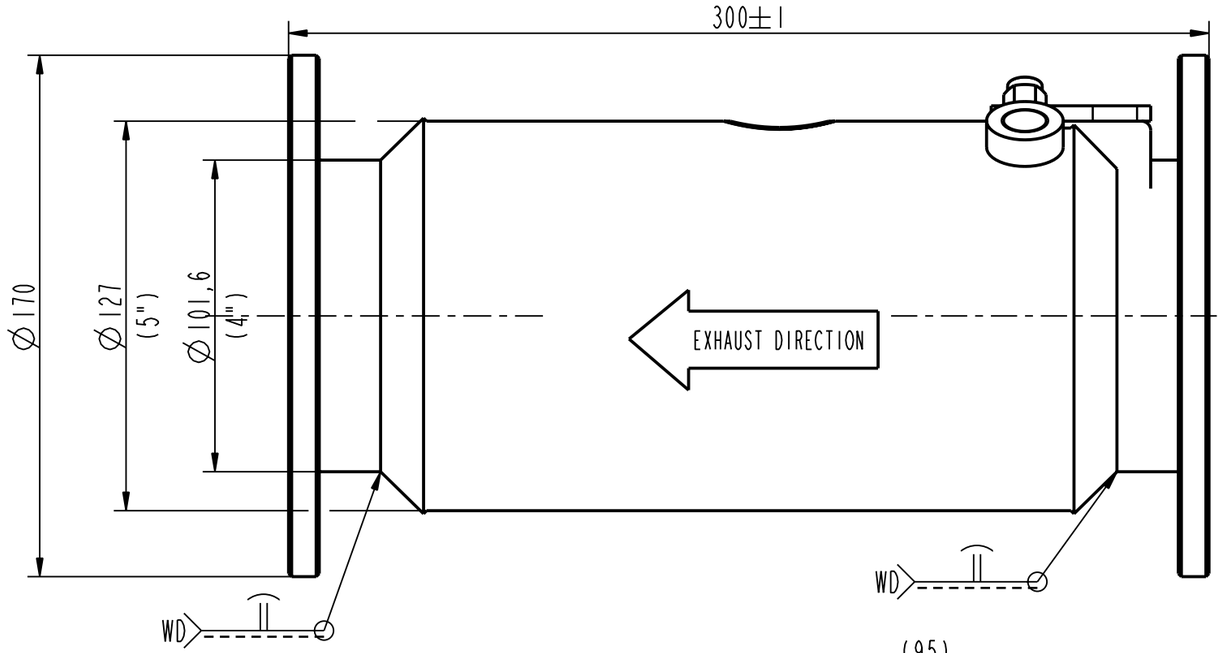
STT

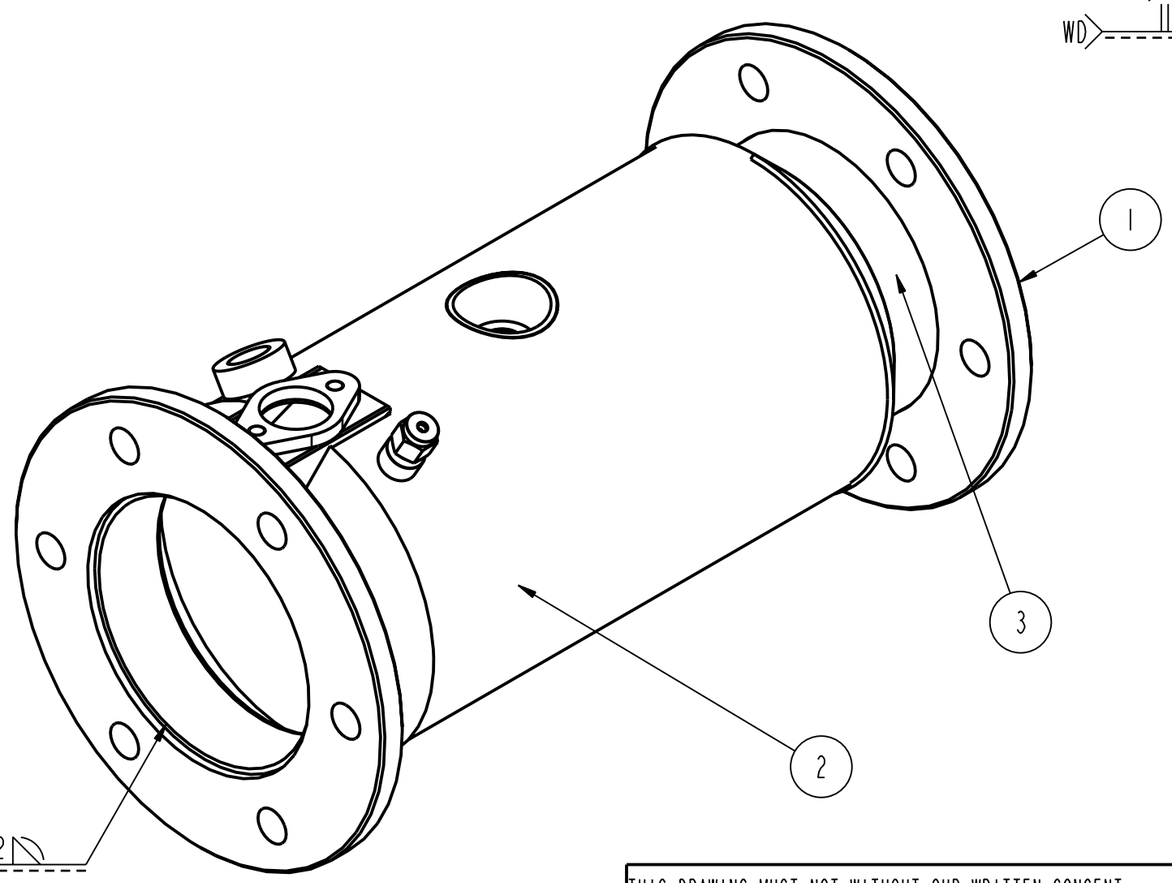
A2

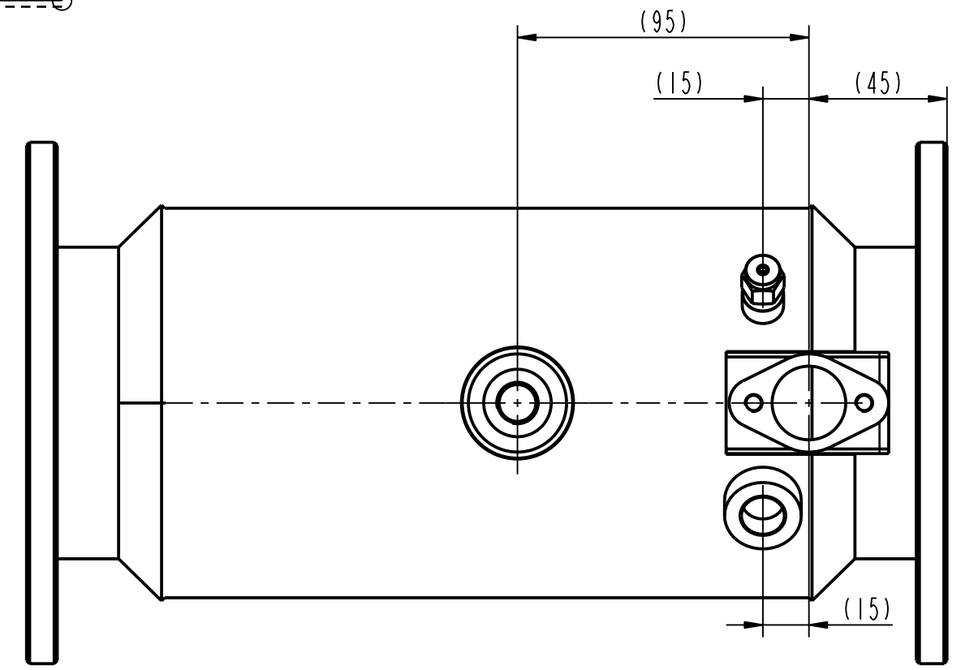
Product No. Kit	Pos	Product No. Components	Description	Quantity	Sign.
108437-00	00	OP1003	Assembly	1	
	01	108445-00	Can In. Assy 90° 11,25" Marin	1	
	02	108446-00	Can Out Assy 11,25" Marin	1	
	03	107515-00	Catalyst 11,25" W. Heat Shield	1	
	04	108407-00	Filter 11,25" W. Heat Shield	1	
	05	107688-00	Clamp V-DPF 10.5" & 11.25"	3	
	06	105105-02	Gasket 10,5" & 11,25" DPF Assy	3	
	07	107633-00	Marking Plate, T_HTR	1	
	08	106198-00	Marking Plate, T_DOC_O	1	
	09	106196-00	Marking Plate, Stt logo w pn	1	

Rev.	Loc.	Change note a=added, w=was d=deleted	Date	Sign.









Pos.	Qant.	Description	Material	Mod.nr blank Dimension	Part no.

General tolerances for dimensions without tolerance indication according to ISO 2768 -m	Surface roughness Ra µm	Projection Method

Designed	Drawn	Copy	Checked	Stand.	Appr.	Scale	Replace.	Replaced by
SB/LM	LM		UE		UE	1:2		

stt emtec

IGNITER UNIT
5" With 4" MFlange

Filename	Date
	130129

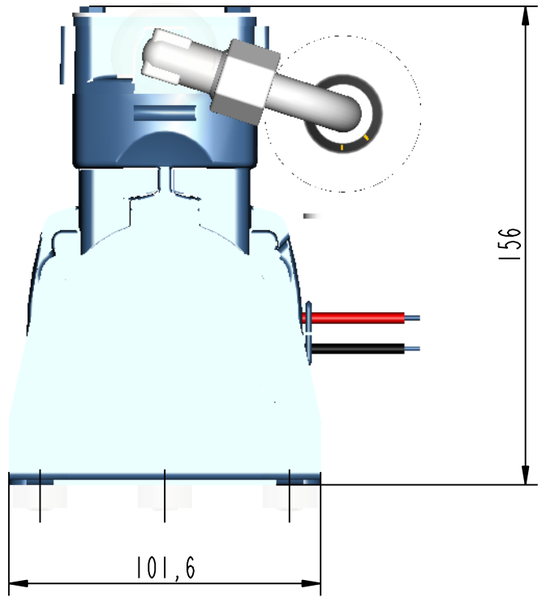
Dwg. no	Rev
108439	00

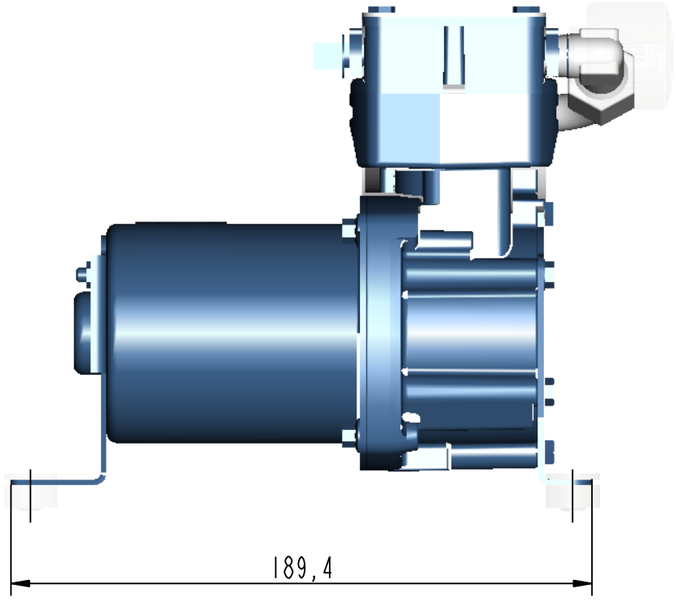
A3

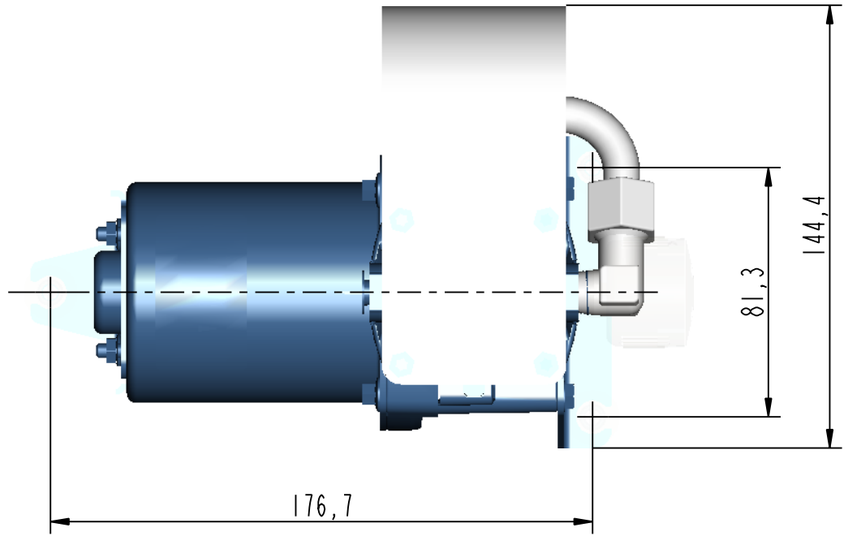
Product No. Kit	Pos	Product No. Components	Description	Quantity	Sign.
108439-00	01	108438-00	Flange (4") Ø102/Ø170	2	
	02	108594-00	Igniter Unit 5" w 4" Conn	1	
	03	108588-00	Pipe 101,6 l=27	2	

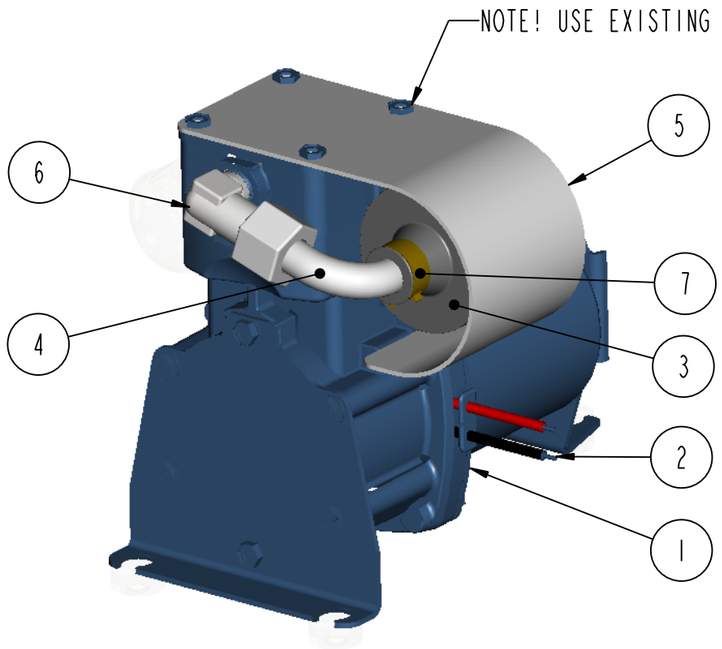
CONFIGURATION	PRESSURE/VACUUM
STROKE	0.56 INCHES
PRESSURE, BAR	FLOW, l/min
0	29.8
2	24
4	20.1
6	17.5
8	14.9
10	12.3
MAX PRESSURE	10.3 BAR
MAX DUTY CYCLE	30%
MAX VACUUM	0,8 BAR
MAX AMBIENT TEMPERATURE	+70°C
MIN AMBIENT TEMPERATURE	-40°C
MOTOR VOLTAGE	24VDC
CURRENT AT RATED LOAD	-
FULL LOAD SPEED	3100rpm
NET WEIGHT	2.3KG

Rev.	Loc.	Change note a:added, w:was d:deleted	Date	Sign.









CONNECTOR (WEATHERPACK, NOT SHOWN)

Pos.	Qant.	Description	Material	Mod.nr blank Dimension	Part no.

General tolerances for dimensions without tolerance indication according to ISO 2768 -m	Surface roughness Ra µm	Projection Method

Designed	Drawn	Copy	Checked	Stand.	Appr.	Scale	Replace.	Replaced by
UE	UE		-		-	1:2		

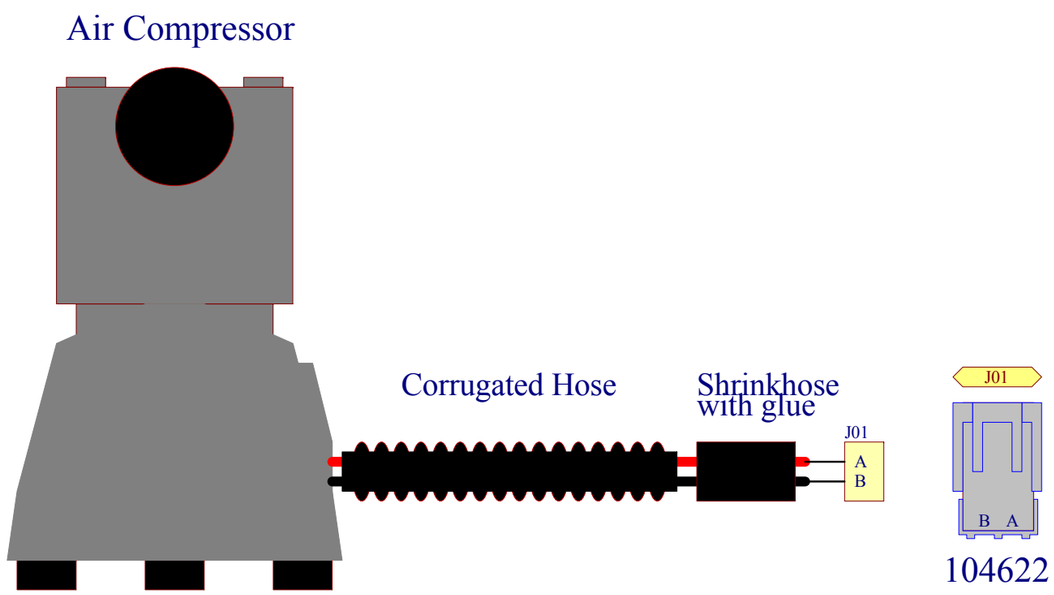
stt emtec

AIR COMPRESSOR
24V

Filename	Date
	120905

Dwg. no	Rev
108478	00

A3



Title: Air Compressor 24V		
Size: A4	Number: 108478	Revision: 00
Date: 14-Aug-2007		Sheet of
File: P:\PROJEKT\Aktivt filter\BT Svenska\El-system\BT00\AirCompressor12V.ddb		Drawn: BT00

Product No. Kit	Pos	Product No. Components	Description	Quantity	Sign.
108478-00	00	OP1003	Assembly	1	
	01	108477	Air Compressor, CCT 24V	1	
	02	104622	Delphi WeatherPack 2p mal assy	1	
	03	106623-02	Filter, Air Compressor	1	
	04	106663-00	Pipe, Air Compressor	1	
	05	106819-00	Filter Cover, Air Compressor	1	
	06	106820	Fitting compressed 90deg, 12mm	1	
	07	480-00-0668.0	Clamp Hose d=17 W=8 C2 AML	1	

Appendix 3 Service and maintenance

*Note: The service interval is indicated in both calendar time and operating hours. The interval should be interpreted as the **shortest** of the two. See also CCTmarine documentation for further maintenance points.*

Component	See section	6 mon. 1500h	12 mon. 3000h	24 mon. 6000h
Flange connections		**I**		
Coolant water connection and hoses		**I**		
EGR valve		**I**		
EGR filter		**I**	**R**	
EGR cooler		**I**		
EGR pickup		**I**		

I= Inspect (if necessary, clean, adjust or replace), C = Clean, R = Replace.

Required service

3.1 Flange connections

Inspection leakage
Tightening clamps

3.2 Coolant water connections and hoses

Inspection leakage
Tightening hoses

3.3 EGR valve

Test valve function
Inspection strainer
Inspection leakage

3.4 EGR filter

Inspection filter
Replace filer

3.5 EGR cooler

Inspection leakage, gas side
Inspection leakage, coolant side

3.6 EGR pickup

Inspection leakage

Appendix 4 Technical specifications

4.1 EGR pickup

Material:	Stainless steel AISI 316/316L, AISI 304/304L
Dimensions (D x L):	170 x 300 mm
Weight:	3.8 kg
Medium:	Exhaust gas
Temperature:	Operating temperature 250°C-500°C (482ºF- 932ºF).
Cleanliness requirements:	SS2678

4.2 EGR cooler

Material:	Stainless steel AISI 304/304L
Weight:	3.0 kg
Dimensions (D x L):	80 x 410 mm
Medium:	Exhaust gas
Cooling medium:	Engine coolant
Cleanliness requirements:	SS2678

4.3 EGR filter

Material:	Stainless steel AISI304
Weight:	1.9 kg
Dimension (D x H):	124 x 192 mm
Medium:	Exhaust gas (<250˚C)
Cleanliness requirements:	SS2678

4.4 EGR valve

Material:	Die cast Aluminium, ABS plastic, Stainless steel AISI 304/304L, electronics
Weight:	2.6 kg
Dimensions (W x L x H):	174 x 116 x 287 mm
Medium:	Inlet air, exhaust gas (<250˚C)
Cleanliness requirements:	SS2678

4.5 Wiring harness

Material, sheath:	Halogen Free Polyolefin Compound
Material, conductor:	Cu (IEC 60228), pair-twisted
Insulation voltage:	1500 V
Ambient temperature:	-20 / +70 ˚C

Appendix 5 Troubleshooting guide

The troubleshooting guide also includes a description on how to use the diagnose application **EmtecDiag.**

The troubleshooting guide can vary between applications.

stt emtec
EMISSION & ENGINE TECHNOLOGY

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About the Marine CCT diagnose application

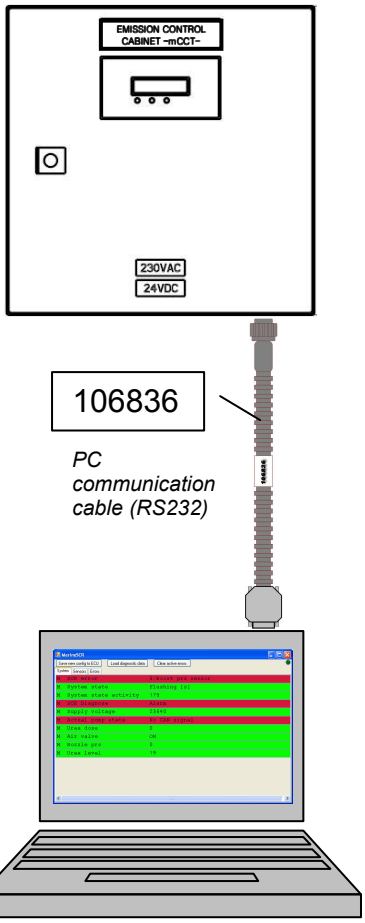
The Marine CCT diagnose application is a PC software designed to support system maintenance and troubleshooting
It is designed to run under Windows XP, Windows Vista and Windows 7 and does not require a hardware lock
Your PC must have at least one available RS232 or USB port

The application installation software comes on a CD labelled *"STT Emtec CCTmarine + DNO$_X$marine Diagnose Application"*
The latest version of the diagnose application can also be downloaded from
http://www.sttemtec.com/

Table of contents

1 Connecting your diagnose equipment

The Marine CCT control cabinet connects to your PC using an RS232 communication cable
(STT part no: 106836)

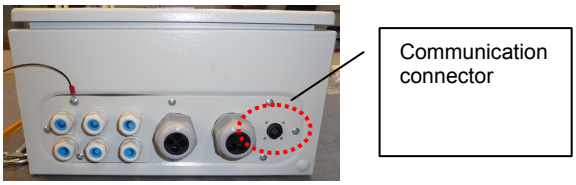


You can use any RS232 or USB port on your PC, the diagnose application will automatically detect where the control system is connected

If your PC does not feature a built-in RS232 connector you should use an additional USB adapter cable
(STT part no: 107926)

USB to RS232 adapter cable

Connect the cable(-s) and make sure that the control cabinet has supply power
Hint: Supply power is on when there is text on the cabinet door display



The connector is located at the bottom right of the Marine CCT control cabinet

2 Overview

EmtecDiag is a monitoring and service tool for STT Emtec ECU's.
It can show runtime data and error codes, download diagnostic data, and update ECU calibration data in the form of complete calibration files.
All files (calibration-, diagnostic data-, and configuration files) are encrypted.

3 Software installation

3.1 *System requirements*

- *1GHz processor or better*
- *512 MB RAM*
- *A Mouse*
- *Windows XP, Windows Vista, Windows 7 or later.*
- *Microsoft .NET Framework 3.51*
- *50 Megabyte free space on the hard disk*
- *RS232 Serial port or USB (on STT's latest ECU's)*

3.2 ECU drivers

STT´s latest generation of ECUs have moved from using a serial port for communication to using USB. This allows for higher communication speeds and better connectivity since many computers are not equipped with serial ports today. To be able to communicate with an ECU using USB, a set of drivers have to be installed. This is done automatically by the EmtecDiag installation program.

3.3 Software setup

Install EmtecDiag and its bundle of drivers and configuration files, by running Setup.exe from the installation CD and following the on-screen instructions.
The setup-program installs EmtecDiag, the drivers for USB-connected ECUs and any configuration files accompanying the setup files. After the setup-program completes, you can start EmtecDiag from the start-menu.
The setup-program will detect if your system already have Microsoft .NET framework 3.5 SP1 installed, and updates your system automatically if needed. The automatic update requires an active internet connection to access Microsoft's servers for downloading the .NET Framework files.
The .NET-framework update is a lengthy task and requires the computer to be restarted, so make sure you plan for it.

4 Program User Guide

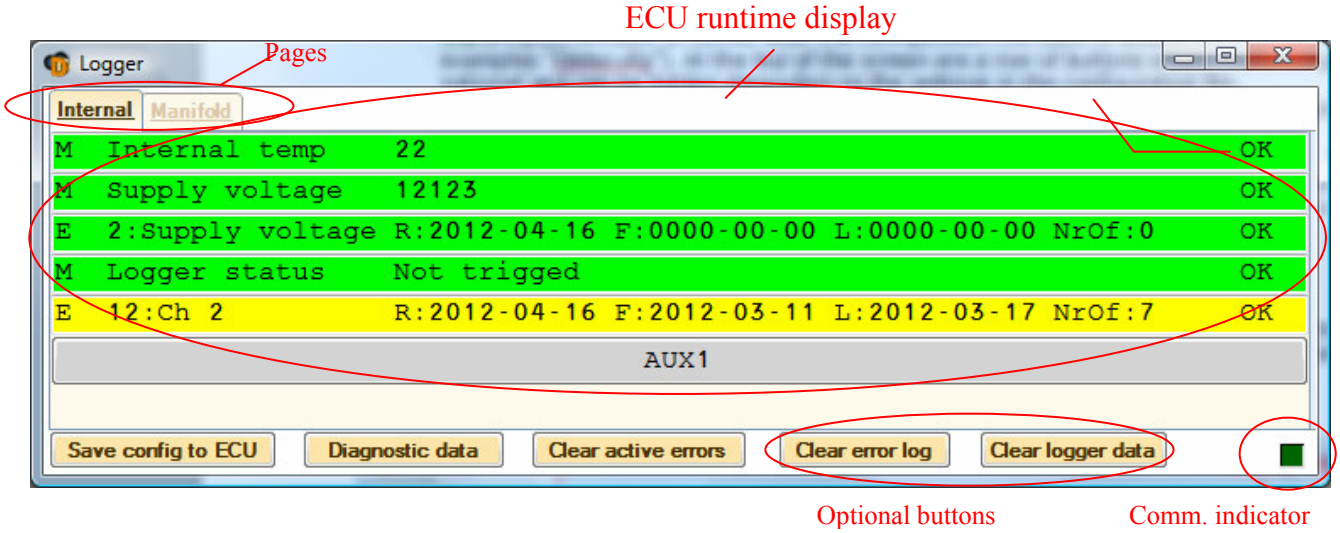
When EmtecDiag is started, it automatically performs a scan of all serial ports on the computer. If it gets a response from a STT ECU, it scans any available configuration file for a match, and connects if one is found. The process requires no user input to connect to an ECU other than starting the program.

4.1 User Interface

The program window is named after the configuration file used to access the ECU (in the following examples "Demo.cfg"). At the top of the screen are a row of buttons where the two rightmost are optional and can be hidden depending on the settings in the configuration file.
On the same level as the buttons, but on the far right of the screen is the communication-indicator which blinks when EmtecDiag is communicating with an ECU.
The runtime information is grouped into pages of Meters, Errors and Control-buttons. The number of pages, their names and content is decided by the configuration file. In these examples, there are two pages ("Engine sensors" and "ECU-info"). Switch between pages by clicking on the desired tab with your mouse.

4.2 Runtime display

The ECU runtime display is composed of Meters, Error information and Control-buttons and its data is updated as long as the ECU is connected (and the Communication Indicator is flashing).
Each line in the runtime display is a different Meter, Error or Control-button.

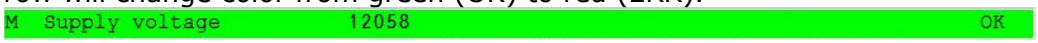


4.3 Display components

There are three different objects that can be found on the runtime display… Meters which typically show sensor readings, Errors which show registered fault-conditions and Control-buttons which can be pushed using the mouse to send commands to the ECU.

Meters

are identified by the "**M**" designator at the far left of its row.
After the designator comes the Meter name and –value. To the far right is its current status, which is determined by preset min- and max values (in the configuration-file). The status can be "OK" or "ERR" and the entire row will change color from green (OK) to red (ERR).

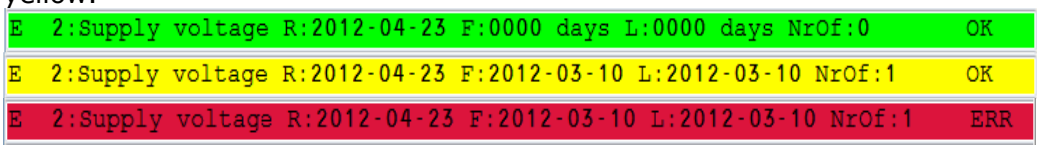


Errors

are identified by the "**E**" designator at the far left of its row. After the designator comes the Error name and a group of other information.

- **R:2011-10-24** – Reset date, is when the error code was last reset by a user.
- **F:0000 days** - First error, is the no. of days after reset the first error occurred.
- **L:0000 days** - Last error, is the no. of days after reset the latest error occurred.
- **NrOf:0** - Error count, is the total no. of recorded errors since reset.

To the far right is the current status of the Error which can be "**OK**" or "**ERR**".
When the Error is currently active, the row turns from green (OK) to red (ERR).
An error that is not currently active, but has stored errors is shown in yellow.

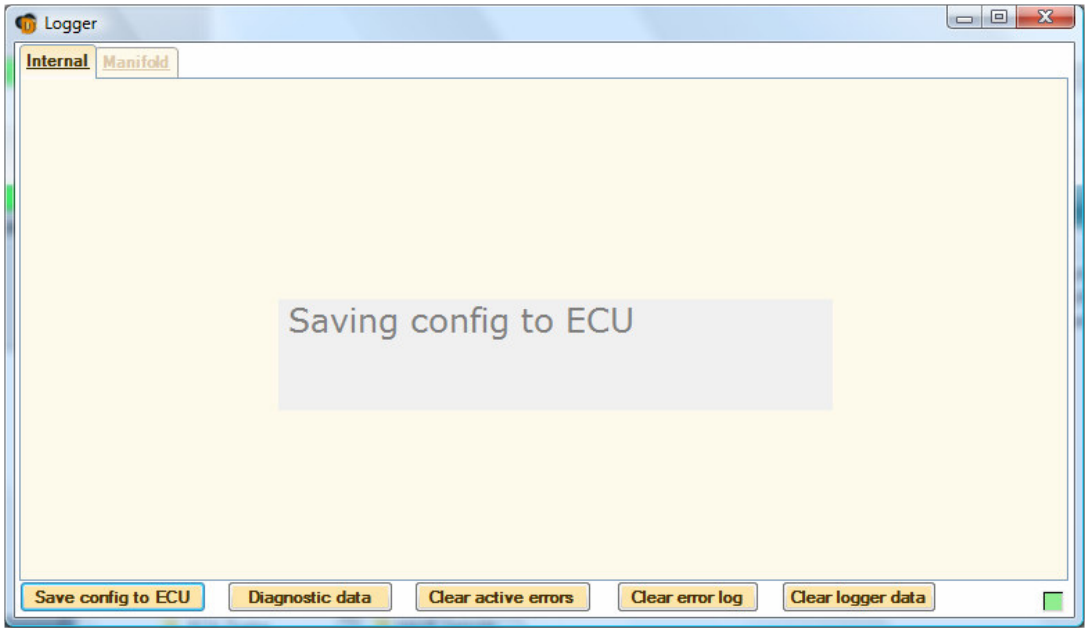


Control buttons

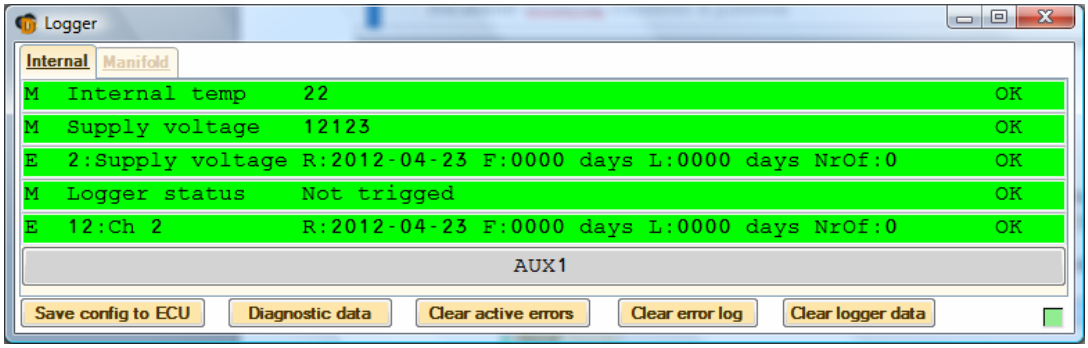
are used to send simple on/off-type instructions to the ECU. Activate the Control button by pressing it with your mouse. Each Control button is labeled with its function.

4.4 Buttons

Use this button to update the dataset in the ECU. A file-selection window pops up when the button is pressed. Navigate to the new dataset-file (extension .mml), select it and press the OK-button.
The text "Saving config to ECU" is shown while the update is in progress.

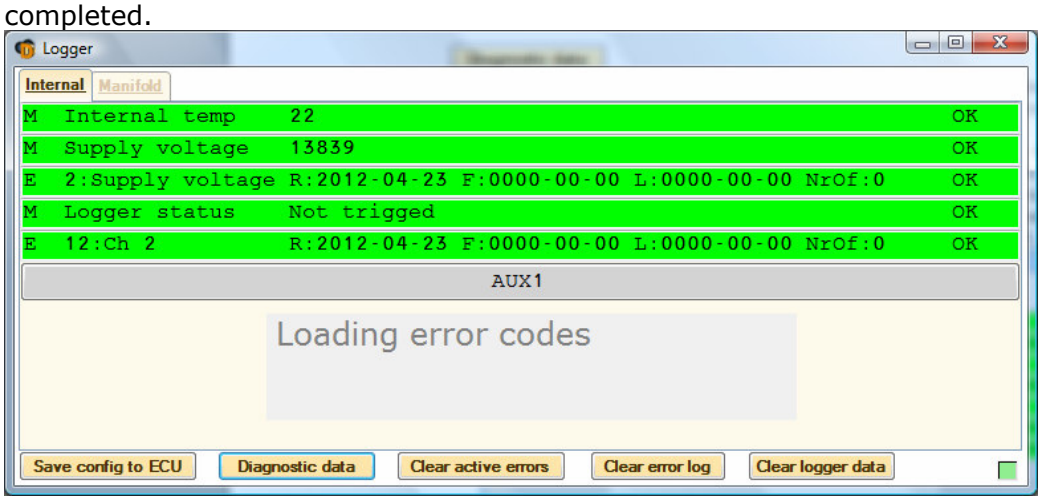


After the dataset has been updated, the runtime communication is resumed.

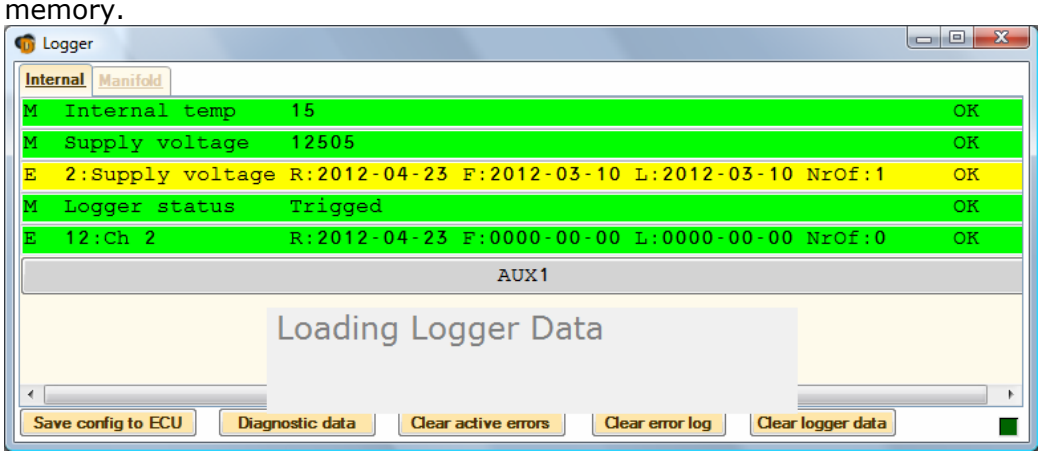


Diagnostic data

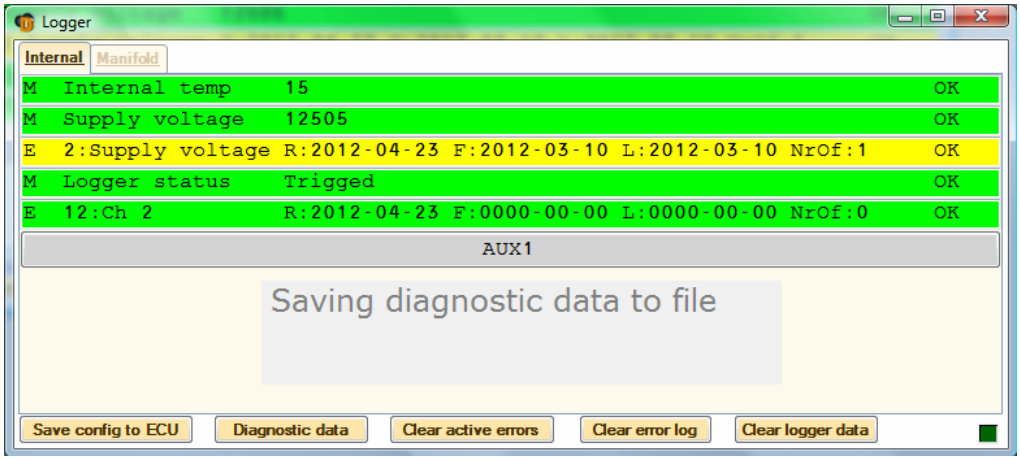
Downloads all stored error codes in the ECU to a file. Depending on the settings in the configuration file, logger data may be included in the download. If this is the case, the download will take longer to complete. You will be asked for a file name when the button is pressed. An automatically generated file name will be presented as a suggestion, but the user is free to change it. The download will start when the Save-button is pressed. If the configuration file allows it, the logger data is shown to the user as a graph. Normal operation is resumed after the download is completed.



Logger data being downloaded. This is a long task if the ECU has a large memory.



After download of the logger data, it is saved to the diagnostic data file. This can take some time if there is a lot of data. The downloaded diagnostic data file is in binary form and not in readable text. The ECU configuration tool "EmtecMapper V" is used to extract readable data from the file.



Clear active errors

Resets currently active error codes in the ECU. On ECU's with support for this function, the current error-states of all Errors are set to "OK" while the ECU re-evaluates them all. On ECU's lacking this function, all error counters will be reset, and the reset date will read 1970-01-01.

Clear error log

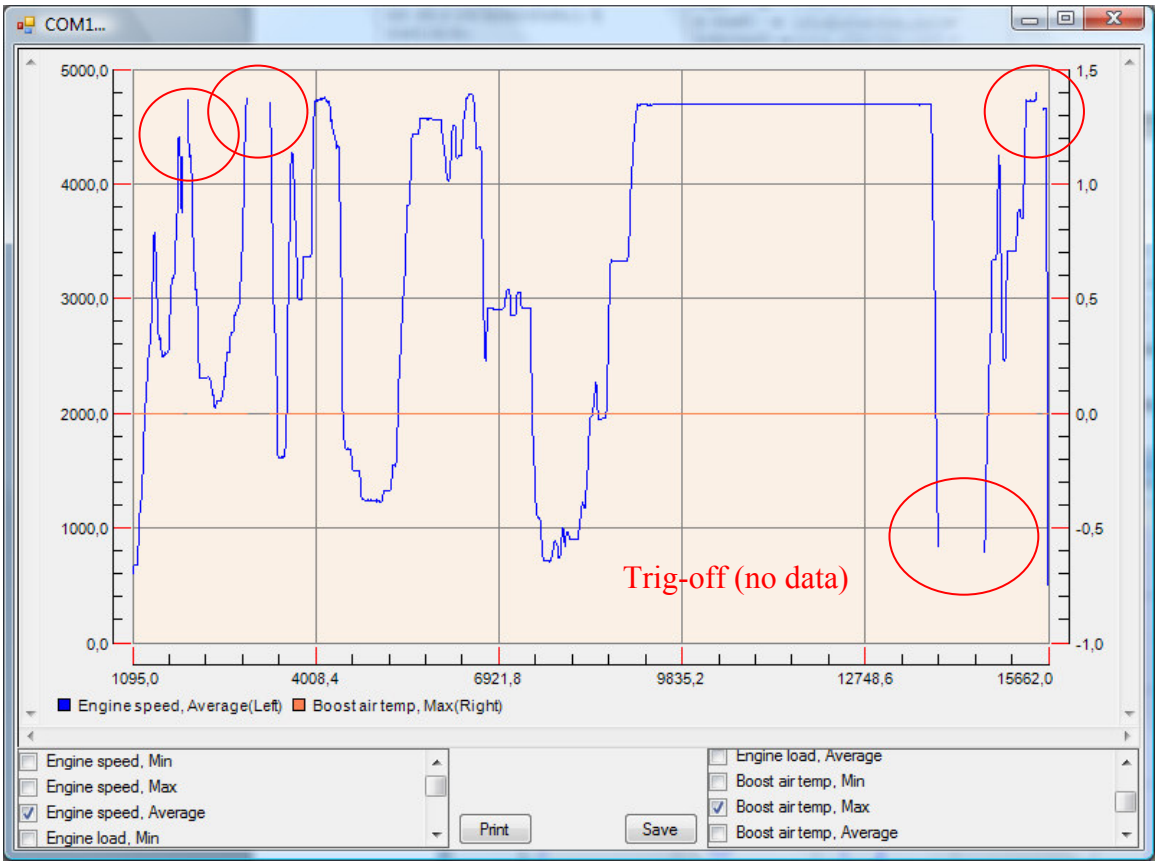
This button is optional, and may not be shown for all installations.
Resets all error counters in the ECU and sets the reset time to the current date.

Clear logger data

This button is optional, and may not be shown for all installations.
Clears all logged data in the ECU along with any stored Alarms.

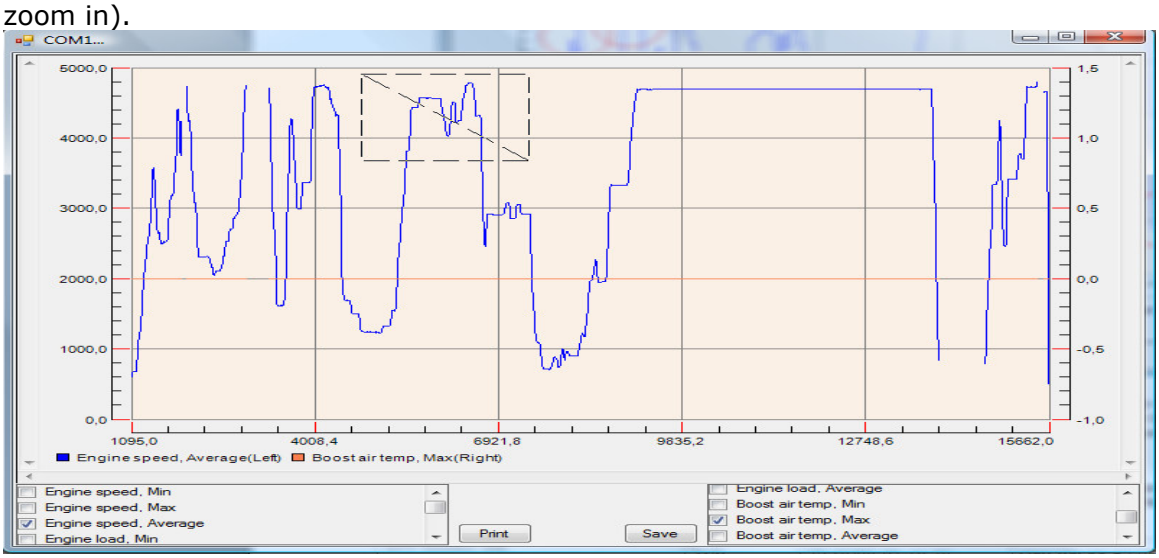
4.5 Logdata graph

If the settings in the configuration file allow it, some- or all of the data is presented in graph form. The logdata-viewer can plot data on both the left- and right axis of the graph. Use the checkboxes to select on which axis to plot the data. The selected traces are plotted, each in a different color and a legend with information on which axis they belong to is shown below the graph area. If the trace is broken, the logger has been trigged-off during that time.



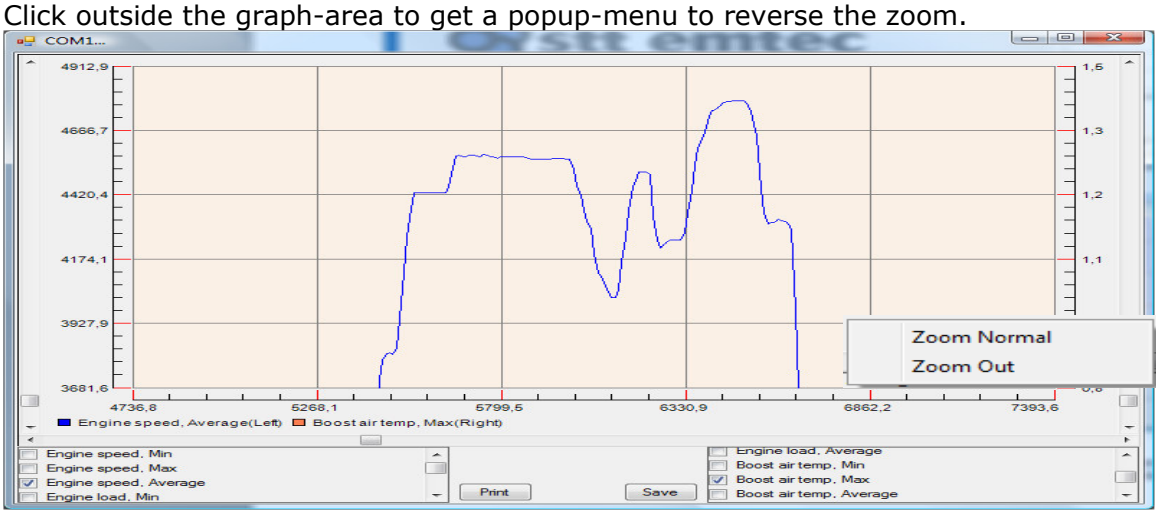
Zooming

Zoom in to view details by selecting an area with your mouse (press-and-hold the left mouse button in the graph area and drag the mouse. Release the mouse to zoom in).



After zoom… When zoomed in, use the scroll bars to pan around in the graph area.

Click outside the graph-area to get a popup-menu to reverse the zoom.



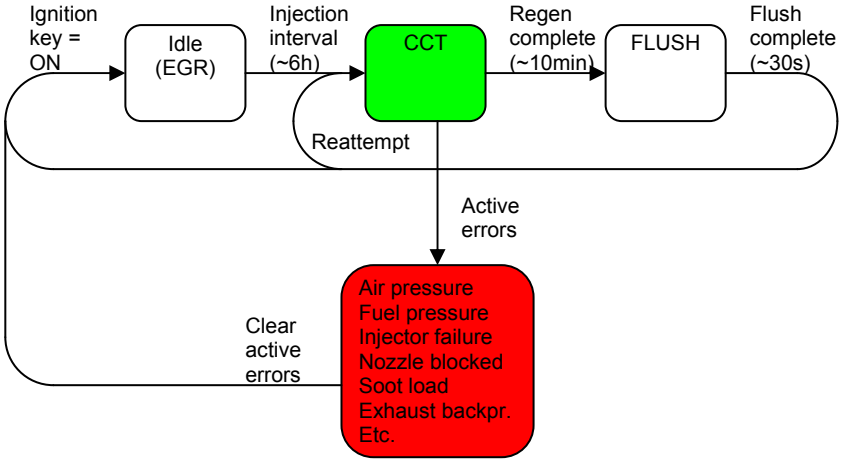
The **Print**-button will print the current graph, as seen on the screen

The **Save**-button saves the current view (selected traces only, and only the time span shown on screen, i.e. the zoomed in data only) to a TAB-separated text file for easy import into a spreadsheet.

5 System state

The control system operates in three states according to the figure below. During DPF cleaning (CCT) and FLUSH states EGR is disabled. Most fault condition will force the system to EGR state. Depending on the fault code EGR may also be disabled.

Note: some fault codes must be manually cleared using Clear active errors **before full operation is restored.**



Note: EGR is an option only active when the CCT*marine* is combined with a **DNO$_X$*marine*** control system. When a **DNO$_X$*marine*** is not fitted all references to 'EGR' may be ignored.

Info tab

This in the main diagnose tab. It gives an overview of the system operation.

Name	Meaning	Default (Ok) value	Red background
Errors	Will scroll thru any active trouble codes at a 2s rate Codes are presented in plain text, see *DTC tab* for more information *Note: trouble codes may show on Errors before they appear in the DTC tab*	N/A	Any trouble code
Current state	For monitoring system operation **System not ready**: Automatic installation failed or was not completed **EGR**: EGR enabled, all valves closed on CCT manifold **CCT**: DPF cleaning in progress, air valve open and injector active, EGR disabled **FLUSH**: System actuators flushed with compressed air after DPF cleaning, Flush valve is open intermittently, EGR disabled	N/A	System not ready
State info	For monitoring system operation, provides additional information to Current state **No info**: System in idle state **Complete: Time duration**: **Complete: Temp integral**: The DPF cleaning was successfully completed **Abort: Activation switch** **Abort: Disabled switch** **Abort: DOC inlet temp under time** **Abort: DOC outlet temp under time**	N/A	N/A

Name	Meaning	Default (Ok) value	Red b.g.
State info (continued)	**Abort: DOC inlet under temp** **Abort: DOC outlet over temp** **Abort: Speed under time** **Abort: EGR error** **Abort: INJ error** **Abort: Air pressure error** **Abort: Fuel pressure error** DPF cleaning was initiated but aborted due to this condition **Waiting: Disable switch** **Waiting: DOC inlet temp** **Waiting: HC smoke temp** **Waiting: H2O smoke temp** **Waiting: Start switch** **Waiting: System errors** **Waiting: Activation switch** **Waiting: Installation** DPF cleaning is requested but cannot start until this requirement is fulfilled	N/A	N/A
State activity	For monitoring system operation, provides additional information to State info Will show remaining time or temperature in above state. Ex: Current state= CCT, State info= Waiting: DOC inlet temp, State activity= 36 means that the DOC inlet temperature must raise 36˚C more before the DPF cleaning can start	N/A	N/A
Air pressure [mbar]	Backpressure measured in the injection manifold (Absolute reading = reads 1013mbar at atmosphere) Monitors the air/fuel flow thru the injection nozzle	Idle: 900-1100 mbar DPF cleaning: 1400-1900mbar	N/A

Name	Meaning	Default (Ok) value	Red b.g.
Air pressure [mbar] (continued)	The pressure is a result of diesel and compressed air being forced thru a tight nozzle to form a uniform spray over the DOC A low pressure indicate lack of air pressure or a damaged hose or nozzle A high pressure indicate a clogged nozzle Both high and low nozzle pressure will disabled DPF cleaning	Idle: 900-1100 mbar DPF cleaning: 1400-1900mbar	N/A
Fuel pressure [mbar]	Pressure generated by the fuel pump (Absolute reading = reads 1013mbar at atmosphere) Monitors the operation of the fuel pump and fuel flow thru the injection nozzle A low pressure indicate leakage or fuel pump malfunction A high pressure indicate problem with the fuel pressure regulator or an abnormally high supply voltage Both high and low nozzle pressure will disabled DPF cleaning	Idle: 900-1100mbar DPF cleaning: 4000-5000mbar	N/A
DOC inlet temp [˚C]	Inlet temperature in the DOC For controlling fuel injection during DPF cleaning DPF cleaning will only start if above ~250˚C	Engine specific	N/A
DOC outlet temp [˚C]	Outlet temp of the DOC For monitoring fuel injection during DPF cleaning Cleaning will abcort when below ~200˚C or above ~800˚C	Idle: Follows DOC inlet temp w delay DPF cleaning: ~650˚C	N/A
IGN outlet temp [˚C]	Outlet temp of the igniter module (option) For monitoring fuel injection during DPF cleaning	Idle: Follows DOC inlet temp DPF cleaning: varies up to ~650˚C	N/A
INJ [0-255]	Fuel injector opening rate **0**: injector closed **255**: injector fully open	Idle: 0 DPF cleaning: 0-255	N/A

Name	Meaning	Default (Ok) value	Red b.g.
Exhaust pressure [mbar]	Exhaust gas back pressure before DOC (Gauge reading = reads 0mbar at atmosphere) For monitoring soot load in the DPF A high exhaust pressure indicate a high soot load in the DPF	Engine specific Should typically not exceed 250mbar	N/A
LP EGR actual	Actual EGR rate should equal target EGR rate +/- 10 units **0**: EGR damper closed, AIR damper open **400**: EGR damper open, AIR damper open **800**: EGR damper open, AIR damper closed	EGR: 0-800 DPF cleaning: 0 Flush: 0	
LP EGR servo temperature	Internal temperature of EGR servo motor. The servo is cooled by the inlet air.	<65˚C typical <105˚C intermittent	

Test tab

This tab is useful for testing the components on the injection manifold and the EGR valve. The Fuel relay activates the fuel pump and optionally the air compressor. The Air-/Flush valves engage the corresponding solenoid on the injection manifold. The EGR valve controls the mix between intake air and recirculated exhaust gas.

Name	Meaning	Default (Ok) value	Red background
Fuel pressure [mbar]	Pressure generated by the fuel pump (Absolute reading = reads 1013mbar at atmosphere) Monitors the operation of the fuel pump and fuel flow thru the injection nozzle A low pressure indicate leakage or fuel pump malfunction	Idle: 900-1100mbar DPF cleaning: 4000-5000mbar	N/A

Name	Meaning	Default (Ok) value	Red b.g.
Fuel	Actual state of the fuel pump control relay. Fuel is not injected until the injector is activated. **OFF**: pump is idle **ON**: pump is running May also start the (optional) air compressor	Idle: OFF DPF cleaning: ON Flush: ON	N/A
Fuel relay	Overrides the fuel relay (and optionally air compressor) output Output is active for 5 sec when the control is pressed. Repeatedly pressing the control gives 5 more seconds up to max 1 minute.	N/A	N/A
Air pressure [mbar]	Injection nozzle backpressure measured in the injection manifold (Absolute reading = reads 1013mbar at atmosphere) Monitors the air/fuel flow thru the injection nozzle The pressure is a result of diesel and compressed air being forced thru a tight nozzle to form a uniform spray over the DOC A low pressure indicate lack of air pressure or a damaged hose or nozzle A high pressure may indicate a clogged nozzle	Idle: 900-1100 mbar DPF cleaning: 1400-1900mbar	N/A
Air	Actual state of the fuel solenoid valve on the injection manifold **OFF**: Valve is closed **ON**: Valve is open	Idle: OFF DPF cleaning: ON Flush: OFF	N/A
Air valve	Overrides the air valve solenoid control output. Air flows thru the outer mantle of the coaxial injection nozzle hose. Valve opens when the control is pressed and closes when the control is released. The override is active for 5 seconds; repeatedly pressing the control gives 5 more seconds up to max 1 minute. If the system is equipped with a separate air compressor you must also activate the Fuel relay to obtain proper Air pressure when actuating this valve	N/A	N/A

Name	Meaning	Default (Ok) value	Red b.g.
FLUSH	Actual state of the flush solenoid valve on the injection manifold **OFF**: Valve is closed **ON**: Valve is open	Idle: OFF DPF cleaning: OFF Flush: ON	N/A
Flush valve	Overrides the flush valve solenoid control output. Air flows thru the inner tube of the coaxial injection nozzle hose (fuel line). Valve opens when the control is pressed and closes when the control is released. The override is active for 5 seconds; repeatedly pressing the control gives 5 more seconds up to max 1 minute. If the system is equipped with a separate air compressor you must also activate the Fuel relay to obtain proper Air pressure when actuating this valve	N/A	N/A
LP EGR actual	Actual state of the EGR valve servo **0**: EGR damper closed, AIR damper open **400**: EGR damper open, AIR damper open **800**: EGR damper open, AIR damper closed	EGR: 0-800 DPF cleaning: 0 Flush: 0	N/A
LP EGR valve	Overrides the LP EGR servo. EGR target is 800 when the control is pressed and 0 when the control is released. The override is active for 5 seconds; repeatedly pressing the control gives 5 more seconds up to max 1 minute.	N/A	N/A

Engine tab

This tab show the readings of the engine mounted sensors. They typically are received via an on-board SAE-J1939 CAN databus.

Name	Meaning	Default (Ok) value	Red background
Engine load [%]	For calculating Engine Air to Fuel ratio and Exhaust massflow. For calculating EGR rate in EGR state Full load is 100% Engine idling is typically around 10% Typically CAN (J1939) data from engine	Engine specific	N/A
Engine speed [rpm]	For calculating air mass flow and required fuel injection during DPF cleaning For calculating EGR rate in EGR state Typically CAN (J1939) data from engine	Engine specific	N/A
Boost pressure [mbar]	Air pressure in the inlet manifold [mbar] (Gauge reading = reads 0mbar at atmosphere) For calculating air mass flow and required fuel injection during DPF cleaning For calculating EGR rate in EGR state Typically CAN (J1939) data from engine	Engine specific	N/A
Boost air temp [˚C]	Temperature in the inlet manifold For calculating air mass flow and required fuel injection during DPF cleaning For calculating EGR rate in EGR state Typically CAN (J1939) data from engine	Engine specific	N/A
Air temp [˚C]	For calculating EGR rate in EGR state. To prevent condensate formation EGR is disabled at lower temperatures. Typically CAN (J1939) data from engine	>10˚C	N/A

Name	Meaning	Default (Ok) value	Red b.g.
Water temp [˚C]	For calculating EGR rate in EGR state. EGR is only active when engine is at working temperature. Typically CAN (J1939) data from engine	65-95˚C	N/A
Inlet pressure [mbar]	For calculating EGR rate in EGR state. EGR is disabled if pressure drops. Typically CAN (J1939) data from engine	< -50mbar	N/A
Activation switch	Enables the entire injection system Triggers offset sampling of Gauge emulated sensors Stores volatile data (regeneration timers, operating time etc) into permanent memory **OFF**: System disabled **ON**: System enabled Typically a digital (0V or 12V) signal from the ignition switch or engine activation/shutdown relay	Engine running: ON Engine stopped: OFF	N/A

DTC tab

This tab contains a list of all stored and active trouble codes. Active codes are presented in red in sttDiag.

Note: DTC's with a red marking in the last column will inhibit DPF cleaning and must be immediately attended in order not to damage the DPF. If the box also contains an 'L' the code will not self-restore and must be manually cleared!

Name	Trouble condition	Possible fault	Action	E
Speed sensor	CAN (J1939) sensor not transmitting or Analog sensor reading 0.0V or 5.0V	Damaged sensor Cable break Cable short circuit	Check wiring Replace sensor	
Boost temp sensor				
Boost sensor				
Air temp sensor				
Water temp sensor				

Name	Trouble condition	Possible fault	Action	E
DOC inlet temp sensor	Sensor reading <-100C or >2000C	Damaged sensor Cable break Cable short circuit	Check wiring Replace sensor	
DOC outlet temp sensor				
Exhaust prs sensor	Sensor reading 0.0V or 5.0V			
Air pressure sensor				
Fuel pressure sensor				
Fuel temp sensor				
IGN temp sensor				
CAN communication	Control system cannot communicate with engine J1939 databus			
Exhaust hose blow-off	Sensor reading “frozen” (not changing over time) but within electrical limits	Damaged sensor Hose broken, leaking or plugged	Replace sensor Replace hose	
Boost hose blow-off				
Inlet hose blow-off				
Activation switch	Activation switch = OFF while engine appears to be running (Air massflow > 0)	Cable break Cable short circuit	Check wiring to Activation switch Check sensors relating to Air mass flow; Engine speed, Boost pressure and Boost temp	
Supply voltage	DC supply voltage out of range 12V system: < 11V or > 32V 24V system: <16V or > 32V	Damaged alternator or battery Short circuit in wire or sensor	Check wiring Check battery and alternator	
Air pressure	Nozzle backpressure is out of limit Idle: ~900-1100mbar	Compressed air pressure to low, correct supply pressure is ~4000mbar	Check air compressor fuse and relay (if compressor fitted)	

Name	Trouble condition	Possible fault	Action	E
Air pressure (continued)	DPF cleaning: ~1200-2000mbar Flush: ~1200-2000mbar	Injection nozzle blocked Leakage in nozzle assembly Cable break Cable short circuit	Check air pressure sensor on injection manifold Check wiring	
Fuel pressure	Fuel pressure in injection manifold is out of limit Idle: ~900-100mbar DPF cleaning: ~4000-5000mbar Flush: ~4000-5000mbar	Fuel pump not operating correct Fuel pressure regulator on injection manifold damaged Cable break Cable short circuit	Check fuel pump fuse and rely Check fuel pressure regulator Check fuel pressure sensor on injection manifold Check wiring	
INJ control	The control actuator for the fuel injector solenoid in the injection manifold is measuring a faulty voltage The injector is pulse modulated and the voltage feedback should toggle rapidly between 0 and 12 or 24V	Damaged injector Cable break Cable short circuit *Note: This DTC does not detect a blocked injector or fuel path*	Check injector (resistance ≈ 15Ω) Check wiring	
IGN control	The control actuator for the igniter module is measuring a faulty voltage The injector is pulse modulated and the voltage feedback should toggle rapidly between 0 and 12 or 24V	Damaged igniter module Cable break Cable short circuit	Check igniter (resistance ≈ 1Ω at 25˚C) Check wiring	

Name	Trouble condition	Possible fault	Action	E
EGR control	The servo actuator for the EGR valve cannot assume target position	Mechanical throttle damper failure Throttle return spring broken Damaged EGR servo module Cable break Cable short circuit	Check and clean throttle valve from soot Run EGR valve test procedure (see Post installation inspection procedure) Check wiring and fuses	
Inlet overpressure	Pressure drop over the inlet filter system exceeds ~50mbar EGR is disabled	Engine inlet filter clogged Inlet sensor hose clogged Inlet pressure sensor broken	Check/replace inlet filter Clean hose to pressure sensor Check inlet pressure sensor	
DOC outlet overtemp	Temperature downstream the DOC is above ~850˚C Indicates that too much fuel is injected during DPF cleaning	Sensor failure; DOC inlet temperature, DOC outlet temperature, Engine speed, Boost pressure, Boost temp TC lube oil leakage into exhaust stream, Major exhaust pipe leakage upstream DOC	Check DOC and DPF for damage from overtemperature Check exhaust piping Check turbocharger Check sensors	**L**
Exhaust pressure warning	Exhaust backpressure before the DPF is to high The limit is application specific but should typically not exceed ~250mbar May also set the soot level warning/alarm Typically follows upon any regeneration error	Soot build-up in DPF or DOC See Soot level warning/alarm	Check and clean DPF and DOC Check injection nozzle Check Igniter	
Exhaust pressure alarm				**L**

Name	Trouble condition	Possible fault	Action	E
Soot level warning	The soot load of the DPF is to high for the cleaning process to start. Attempting to clean the DPF at high soot load may damage the filter. May also set the Exhaust pressure warning/alarm	Soot build-up in DPF or DOC due to repeated regeneration failure, inspect trouble code list for root cause failure(-s) e.g; Partially blocked injection nozzle Damaged DOC Damaged Igniter	Check DPF and DOC Check injection nozzle Check Igniter **Note: If the warning is left unattended there is a great risk that the fault code will progress into alarm where the DPF must be removed and manually cleaned!**	
Soot level alarm			Manually clean DPF and DOC Check injection nozzle	**L**
Soot low level alarm	The measure backpressure before the DPF is too low. The limit is application specific but should always be above 0mbar when engine is running	Exhaust leakage in DPF, DOC or piping Exhaust pressure sensor failure	Check DOC and DPF assembly Check Exhaust pressure sensor	**L**
Regeneration frequency warning	The DPF cleaning process is activated too frequently	Ash build-up in DPF Rapid soot build-up in DPF (abnormal engine smoke level is abnormally high)	Check/clean DPF and DOC Check engine (TC, injectors)	
Regeneration frequency alarm				**L**
Regeneration interval warning	The DPF cleaning process has not been successfully completed within a given interval. The interval is application specific but is typically around	Engine running at to low load (for the DPF cleaning process to start or complete) over an extended period	Operate engine at higher load Check/replace injection nozzle	
Regeneration interval alarm				**L**

Name	Trouble condition	Possible fault	Action	E
Regeneration interval alarm (continued)	16-24h of engine operation See also Soot regeneration restarts	DPF cleaning repeatedly aborted by engine shutoff Damaged injection nozzle		
Regeneration interval warning				
Catalyst conversion	Target exhaust temperature downstream DOC is not reached during DPF cleaning May also set the Regeneration interval warning/alarm	Injection nozzle blocked DOC damaged	Check/replace injection nozzle	**L**
Soot regeneration restarts	The DPF cleaning process has been aborted too often. DPF cleaning require ~15 min of engine running (above idling) to complete. If rpm drops to idling for a longer period or if the engine is shut off the cleaning process will abort. See also Regeneration interval warning/alarm DPF cleaning keeps trying regardless of this alarm	Changed engine/vessel operating cycle Damaged DOC temperature sensors Activation switch circuit failure Damaged wiring harness (regarding DOC temperature sensors and Activation switch)	Verify operating cycle Check DOC temperature sensors Check Activation switch function	
Internal temp	ECU internal failure	N/A	Replace control unit	
Program failure				
Mapdata failure				

Appendix 6 Post installation and inspection

After an installation is completed it is important that the system is checked from a complete list of inspection points and adjustments before the system is and handed over to the operator.

The inspection includes testing alarms, fault codes and its intended default position. The list of inspection points can vary between engines and applications and are therefore presented in an appendix to this document.

This protocol must be followed and completed in order to enable the product warranty and is a part of the documentation package handed over to the system operator.

Group	Sensors
Sub system / actuator/sensor	Inlet pressure sensor

System status during test

Item	**Status**
Compressed air	On
Main switch electrical central for CCT control cabinet	On
Power switch inside the control cabinet	On (enabled)
Service tool connected to the control cabinet	EmtecDiag connected
Engine	Off

Description

The inlet pressure sensor is used to monitor the contamination level of the inlet air cleaning system and to detect backpressure upstream the EGR valve.
The inlet pressure is normally located directly after the inlet air filter/cleaning system and is marked with “PIN”.
Note: This sensor is optional and may be replaced by an other engine/system sensor!

Tests and result

Step	Test	Approved interval	Result	Signature
1	Check that the value on the meter “Inlet pressure” in EmtecDiag corresponds to 0 mbar. (When applicable)	0 mbar ± 10 mbar max.		
2	Disconnect the pressure hose to the sensor and apply a known (negative) pressure to the sensor. Note: max pressure -1000 mbar. (When applicable)	± 10 mbar max difference to the applied pressure.		
3	Disconnect the electrical connection to the sensor and verify that the corresponding error code ‘Inlet pressure sensor’ is set. (When applicable)	Error active		

Group	Sensors
Sub system / actuator/sensor	Inlet temperature sensor

System status during test

Item	**Status**
Compressed air	On
Main switch electrical central for CCT control cabinet	On
Power switch inside the control cabinet	On (enabled)
Service tool connected to the control cabinet	EmtecDiag connected
Engine	Off

Description

The inlet temperature sensor is used to monitor the temperature of the EGR valve air inlet and prevent condensate formation and thermal overloading.
The inlet pressure is normally located directly after the inlet air filter/cleaning system and is marked with "TIN".
Note: This sensor is optional and may be replaced by other engine/system sensors!

Tests and result

Step	Test	Approved interval	Result	Signature
1	Check that the value on the meter "Air temperature" in EmtecDiag corresponds to about ambient temperature.	Ambient temperature ± 5 ˚C max.		
2	Disconnect the electrical connection to the sensor and verify that the corresponding error code 'Air temp sensor' is set.	Error active		

Group	Sensors
Sub system / actuator/sensor	Coolant water temperature sensor

System status during test

Item	**Status**
Compressed air	On
Main switch electrical central for CCT control cabinet	On
Power switch inside the control cabinet	On (enabled)
Service tool connected to the control cabinet	EmtecDiag connected
Engine	Off

Description

The coolant temp sensor is used to monitor the engine temperature. EGR is only active when the engine has reached working temperature (~85˚C).
The coolant temp sensor is normally located at a low point in the engine block and is marked with “CWT”.
Note: This sensor is optional and may be replaced by other engine/system sensors!

Tests and result

Step	Test	Approved interval	Result	Signature
1	Check that the value on the meter “Water temp” in EmtecDiag corresponds to the engine temperature.	Engine temperature ± 10 ˚C max.		
2	Disconnect the electrical connection to the sensor and verify that the corresponding error code ‘Water temp sensor’ is set.	Error active		

Group	Actuators
Sub system / actuator/sensor	EGR valve

System status during test

Item	**Status**
Compressed air	On
Main switch electrical central for CCT control cabinet	On
Disable switch inside the control cabinet	Off (disabled)
Service tool connected to the control cabinet	EmtecDiag connected
Engine	Off

Description

The EGR valve controls the amount of recirculated exhaust gas to the engine. The EGR valve is located between the engine air intake and the turbocharger and is marked with "EGR". Dismount the air inlet of the EGR valve so that both the air and the exhaust throttles are visible before the test.

Tests and result

Step	Test	Approved interval	Result	Signature
1	Disable switch Off – no power. Both throttle valves should be open	Valves open		
2	Disable switch On – power on. Both throttles move in a test pattern for ~2s after which the air throttle (big damper) remain open and the exhaust throttle (small damper) remain closed	Test pattern followed by open air throttle and closed exhaust throttle		
3	Disconnect the electrical connection to the valve and verify that the corresponding error code 'EGR control' is set in EmtecDiag	Error active		
4	Reconnect the electrical connection to the valve and press and hold the control 'LP EGR valve'. The meter 'LP EGR actual' should show 800 for 10s The control can be found in the "Test" tab in Emtec diag or under Controls/Test in EmtecDiag	800		
5	Release the control 'LP EGR valve'. The meter 'LP EGR actual' should return to 0.	0		

Group	Piping
Sub system / actuator/sensor	EGR cooler

System status during test

Item	**Status**
Compressed air	On
Main switch electrical central for CCT control cabinet	On
Power switch on inside the control cabinet	On (enabled)
Service tool connected to the control cabinet	EmtecDiag connected
Engine	On

Description

When the engine is running the coolant water lines are pressurized and coolant is circulated. When the engine is operating at working temperature exhaust gas is flowing thru the cooler.

Tests and result

Step	Test	Approved interval	Result	Signature
1	Run the engine to working temperature and note that the meter 'LP EGR actual' goes above 0. *Note: EGR is inactive in some conditions, such as idling; make sure you run the engine at an working point (speed and load) where EGR is enabled ('LP EGR actual' > 0)*	LP EGR actual > 0		
2	Use a thermometer (e.g. an IR thermometer) to verify that the gas outlet of the cooler is noticeably cooler than the inlet.	Tout >> Tin		
3	Use a thermometer (e.g. an IR thermometer) to verify that the gas outlet of the cooler does not exceed 170˚C	Tout < 170˚C		
4	Use a thermometer (e.g. an IR thermometer) to verify that the water outlet of the cooler is not more than 5˚C warmer than the water inlet	Twout - Twin < 5˚C		

Group	Piping
Sub system / actuator/sensor	Coolant water lines

System status during test

Item	**Status**
Compressed air	On
Main switch electrical central for CCT control cabinet	On
Power switch on inside the control cabinet	On (enabled)
Service tool connected to the control cabinet	EmtecDiag connected
Engine	On

Description

When the engine is running the coolant water lines are pressurized and coolant is circulated. When the engine is operating at working temperature exhaust gas is flowing thru the cooler.

Tests and result

Step	Test	Approved interval	Result	Signature
1	Inspect coolant pipes and hoses for leakage	No leaks		

Group	EGR lines
Sub system / actuator/sensor	Piping

System status during test

Item	**Status**
Compressed air	On
Main switch electrical central for CCT control cabinet	On
Power switch inside the control cabinet	On (enabled)
Service tool connected to the control cabinet	EmtecDiag connected
Engine	On

Description

When the engine is operating at working temperature exhaust gas is recirculated.

Tests and result

Step	Test	Approved interval	Result	Signature
1	Run the engine to working temperature and note that the meter 'LP EGR actual' goes above 0.	>0		
2	Inspect EGR pipes for leakage	No leaks		

After finalization of the post installation inspection checks, clear the error code list and disconnect the service tool.

Make sure that all connectors and hoses are reinstalled properly and leave the disable switch inside the control cabinet on (enabled) and the compressed air valve open.