

404J-E22T

400

45 kW Gross @ 2800 rpm

EU Stage V/U.S. EPA Tier 4 Final/Japan 2014 (Tier 4 Final)

Industrial Open Power Unit

Series

Basic technical data

Number of cylinders	4
Cylinder arrangement	Inline
Cycle	Four stroke
Induction system	Turbocharged
Compression ratio	17.3:1
Bore	84 mm
Stroke	100 mm
Displacement	2.22 litres
Direction of rotation (viewed from flywheel)	Anticlockwise
Firing order (cylinder 1 furthest from flywheel)	1,3,4,2
Lifting point location (as defined when looking from flywheel end)	Rear left & front right
Mobile use g-load limitations	7

Weight of IOPU

Dry (estimated)	281 kg
Wet (estimated)	296 kg

Overall dimensions of IOPU

Height	985 mm
Length	965 mm
Length (including fuel cooler)	965 mm
Width	622 mm

Centre of gravity of IOPU

Wet, forward from rear of block	230 mm
Wet, above centre line of block	126 mm
Wet, offset to right hand side of crankshaft centre line	1 mm

Moments of inertia (mk²)

Engine rotational components (excluding flywheel)	0.10 kgm ²
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Operation

Speed variation at constant load	±5 rpm
All ratings certified to within	±5 %
Maximum Intermittent Ratings	C-Tier

Emissions capability

Emissions certification	EU stage V
Aftertreatment type	DOC+DPF
Aftertreatment configuration ¹	Engine mounted

Notes:

- Perkins maintains ISO9001:2000 certified quality management systems for engine test facilities to assure accurate calibration of test equipment
- all data based on operation to ISO 3046/1:2002 standard reference conditions
- for engines operating at increased ambient temperature and/or altitude conditions suitable adjustments must be made
- all data is subject to a tolerance of ±5%, power delivery tolerance is stated separately
- performance data quoted will be influenced by installation parameters which must be verified at sign off
- unless stated otherwise, key parameters are provided for Full Load Rated Speed (FLRS), for other values please refer to the ESM
- please refer to the relevant Operation and Maintenance Manual (OMM) for engine servicing details including coolant, fuel, oil and Diesel Exhaust Fluid (DEF) requirements where applicable
- for additional product information please refer to the relevant ESM, A&I Manual or contact Perkins Applications Engineering

Footnotes:

1. Alternative options are available for aftertreatment configuration.

General installation, Rating T5074

Designation	Units	Engine speed (rpm)					
		1500	1800	2100	2300	2500	2800
Gross engine power output	kW	34.2	39.6	43.0	44.3	45.0	45.0
Gross BMEP	kPa	1234	1191	1108	1043	974	870
Nett engine power (with puller fan and alternator at no load)	kW	33.6	38.4	41.0	41.7	41.7	40.5
Nett engine power (with pusher fan and alternator at no load)	kW	33.6	38.4	41.0	41.7	41.7	40.5
Air mass flow (wet)	kg/min	2.6	3.0	3.5	3.8	4.1	4.5
Exhaust gas temperature at aftertreatment outlet	°C	438.7	450.2	461.4	464.0	466.1	469.8
Exhaust gas flow rate volume (wet) at tailpipe	m³/min	5.3	6.3	7.3	7.8	8.4	9.1
Exhaust gas mass flow (wet)	kg/min	2.7	3.2	3.7	4.0	4.3	4.7

Reference conditions for technical data

Air temperature 25 °C
 Barometric pressure 102.0 kPa
 Relative humidity 32 %

Fuel temperature (inlet pump) 40 °C
 Air inlet restriction at maximum power (nominal) -4 kPa
 Exhaust back pressure at maximum power (nominal)..... 8 kPa

Energy balance²

Designation	Units	Engine speed (rpm)					
		1500	1800	2100	2300	2500	2800
Energy in fuel	kWt	87.2	101.7	113.8	120.3	125.5	132.2
Energy in power output (gross)	kW	34.2	39.6	43.0	44.3	45.0	45.0
Energy to puller fan and alternator at no load	kWm	0.6	1.2	2.0	2.6	3.3	4.5
Energy to pusher fan and alternator at no load	kWm	0.6	1.2	2.0	2.6	3.3	4.5
Energy to exhaust ³	kWm	35.6	42.4	49.8	54.2	58.5	64.6
Energy to charge air	kWt	12.8	15.0	17.5	18.9	20.4	22.5
Energy to coolant radiator	kWt	24.9	28.6	31.7	33.5	34.9	37.5
Energy to radiation (atmosphere) ⁴	kWt	5.2	6.1	6.8	7.2	7.5	7.9

2. Data included in the energy balance table should not be used for combined heat and power (CHP) purposes.
3. Not to be utilised for heat recovery, does not include energy input from combustion air.
4. Includes heat rejected to fuel via return to tank flow.

Cooling system

Cooling pack

Overall weight (wet)	47 kg
Overall cooling pack face area	0.43 m ²
Width	564 mm
Height	765 mm

Radiator

Radiator face area	0.28 m ²
Core material	Aluminium
Number of rows	1
Fins per inch	12.7
Width of matrix	526 mm
Height of matrix	524 mm
Pressure cap setting	110 kPa

Fan (pusher)

Fan type	Mechanical, fixed
Configuration	Pusher
Option code	M0042
Diameter (tip to tip)	460 mm
Number of blades	7
Material	Plastic

Fan (puller)

Fan type	Mechanical, fixed
Configuration	Puller
Option code	M0043
Diameter (tip to tip)	460 mm
Number of blades	7
Material	Plastic

Coolant

IOPU coolant capacity (with radiator)	8.7 litres
Engine coolant capacity (without radiator)	4.5 litres
Maximum top tank temperature	112 °C
Maximum static pressure head on pump	100 kPa
Coolant temperature rise across engine	14.4 °C
Thermostat operation range (closed to fully open)	82/95 (+/-3) °C
Recommended coolant	ELC 50:50 premix

Specifications

Specifications	Units	Engine speed (rpm)		
		1500	2100	2800
Compressor outlet temperature at standard 25°C test condition	°C	137	137.8	141.7
Compressor outlet pressure (gauge) at standard 25°C test condition	kPa	116.6	124.7	127.1

Duct allowance

Duct allowance, M0042 Pusher

Duct allowance ⁵ (Pa)		Units	Engine speed (rpm)				
			1600	1800	2000	2400	2800
0	Ambient clearance ⁶	°C	55	55	55	55	55
	Resultant minimum fan airflow	m ³ /sec	1.29	1.45	1.61	1.94	2.26
60	Ambient clearance ⁶	°C	48	48	48	48	48
	Resultant minimum fan airflow	m ³ /sec	1.25	1.41	1.47	1.76	2.06
120	Ambient clearance ⁶	°C	Not permitted	Not permitted	48	48	48
	Resultant minimum fan airflow	m ³ /sec	Not permitted	Not permitted	1.47	1.76	2.06

Duct allowance, M0043 Puller

Duct allowance ⁵ (Pa)		Units	Engine speed (rpm)				
			1600	1800	2000	2400	2800
0	Ambient clearance ⁶	°C	55	55	55	55	55
	Resultant minimum fan airflow	m ³ /sec	1.32	1.49	1.65	1.98	2.31
60	Ambient clearance ⁶	°C	48	48	48	48	48
	Resultant minimum fan airflow	m ³ /sec	1.22	1.37	1.42	1.71	1.99
120	Ambient clearance ⁶	°C	Not permitted	Not permitted	48	48	48
	Resultant minimum fan airflow	m ³ /sec	Not permitted	Not permitted	1.42	1.71	1.99

5. Maximum additional cooling airflow restriction.

6. Ambient clearance allows for 5 °C rise above ambient temperature at fan.

Fuel system

Fuel injection pump	Common rail
Fuel injector type	Electronic
Filtration media size	Primary 10, Secondary 4 µm
Priming pump type	Solenoid pump
Fuel lift pump type	Electric
Primary filter	Off engine
Lift pump	Off engine
Secondary filter	Engine mounted
Maximum fuel supply restriction at lift pump inlet	-11 kPa
Maximum fuel return restriction at low idle	20 kPa
Maximum fuel return flow rate	72 litres/hr

Maximum low-pressure system fuel flow rate	138 litres/hr
Maximum pressure measured at main filter inlet	70 kPa
Minimum pressure measured at main filter inlet	30 kPa
Maximum fuel temperature at lift pump inlet	70 °C
Maximum fuel filter service interval ⁷	500 hrs
Governor type	Electronic

Fuel specification

Recommended fuel conformity	EN590
Maximum sulphur in fuel limit	<15 ppm

Fuel consumption⁸

Fuel consumption ⁸	Units	Engine speed (rpm)					
		1600	1800	2100	2300	2500	2800
100% load	g/kWh	216	214	221	226	233	247
75% load	g/kWh	217	211	226	226	244	255
50% load	g/kWh	218	224	242	253	270	300
25% load	g/kWh	253	251	283	314	350	415

Lubricating system

Capacity

Total system capacity	8.5 litres
Maximum sump capacity (maximum dipstick mark)	8.2 litres
Minimum sump capacity (minimum dipstick mark)	6.9 litres

Oil temperatures

Maximum oil temperature (continuous operation)	125 °C
Maximum oil temperature (intermittent operation)	135 °C

Lubricating oil

Relief valve opening pressure	284 (±58) kPa
Minimum oil pressure	150 kPa
Sump drain plug tapping size or hose connection size	M16*1.5
Oil pump drive method	Gear
Oil flow at rated speed	20.4 litres/min
Oil consumption at full load rated speed	0.09 % of fuel
Oil grade	API CK-4

Maximum engine operating angles

Front up, front down	35°
Right side up, right side down	35°

Induction system

Maximum air intake restriction (clean filter)	3.5 kPa
Maximum air intake restriction (dirty filter)	6 kPa
Air filter option	TD001
Air filter type	Standard

Exhaust system

Exhaust outlet diameter, OD	47 mm
Exhaust outlet flange size and type	Pipe
Minimum back pressure at DPF outlet	0 kPa
Maximum back pressure at DPF outlet	3 kPa

7. Operating with fuels that do not meet the recommendations in the OMM can reduce fuel filter service life.

8. For conversion to litres/hr use the following formula with the correct fuel density:
$$\frac{\text{SFC (kg/kWh)}}{\text{Fuel density (kg/litre)}} \times \text{Power (kW)} = \text{Fuel Consumption (litres/hr)}$$

Electrical system

Alternator	Unit	ND003
Alternator output voltage	Volts	12
Alternator output current	Amps	85

Starter		ED001
Starter motor input voltage	Volts	12
Starter motor power draw	kW	2
Number of teeth on flywheel	DD002	126
Number of teeth on starter pinion		9
Minimum average cranking speed	rpm	100
Starter solenoid -Maximum pull-in current at - 20°C	Amps	50
Starter solenoid -Maximum hold-in current at - 20°C	Amps	15

Maximum design G loading capability

X - Rear face of cylinder block ... 4 G
 Y - Crankshaft centre line (horizontal) ... 4 G
 Z - Crankshaft centre line (vertical) ... 6 G

Aftertreatment system

Maximum skin temperature for aftertreatment ... 400 °C
 Typical maximum temperature, aftertreatment out. ... 486 °C
 Aftertreatment outlet maximum static bending moment ... 0.24 Nm
 Typical service life of DPF ... 8000 hrs

Engine mounting

	Unit	Vertical	Lateral
Maximum static bending moment at rear face of block	±Nm	1332	-
Maximum dynamic bending moment at rear face of block	±Nm	Refer to design g-load limits	-

Cold start recommendations⁹

Standard fitted starting aid¹⁰ ... Glowplugs

Minimum starting temperature	Engine oil grade	Minimum battery cold cranking amps with glowplugs (12 volts) ¹⁰	Minimum battery cold cranking amps with glowplugs (24 volts) ¹⁰
°C		CCA	CCA
0	0W-40, 5W-40, 10W-30, 15W-40	740	N/A
-10	0W-40, 5W-40, 10W-30, 15W-40	740	N/A
-20	0W-40, 5W-40	780	N/A
Maximum battery cold cranking amps (CCA)	-	800	N/A

9. Cold cranking amps as per SAEJ537.

10. Ether may be an additional requirement, please contact Apps Engineering

Noise data - Pusher Fan, option M0042

Noise data of the IOPU, this excludes exhaust outlet noise except where specifically stated, measured in a semi-anechoic environment. Measurements taken in accordance with ISO 6798:1995.

IOPU noise level

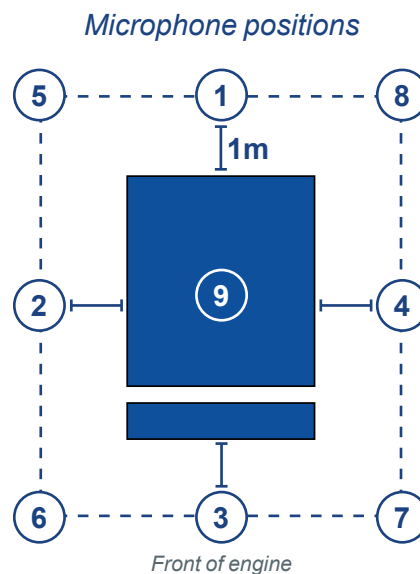
Average sound pressure level ^{10,11} (L_{pA}) at 1m (dBA)	
Full load rated speed (FLRS)	High Idle
95.0	97.1

Exhaust noise level at turbocharger outlet

Exhaust sound power level ¹² (L_{WA}) (dBA)	
Full load rated speed	High Idle
92.1	85.5

Sound distribution around IOPU

Position (reference diagram)	Sound pressure level (L_{pA}) at 1m (dBA)	
	FLRS	Peak torque
1	93.9	94.3
2	95.7	99.7
3	98.7	100.3
4	97.6	99.5
5	90.8	92.4
6	91.9	94.1
7	93.3	94.8
8	89.1	91.9
9	95.5	97.4



11. Sound pressure reference level: 20 μ Pa.

12. For engine, average sound pressure level to sound power conversion add 15.6 dB.

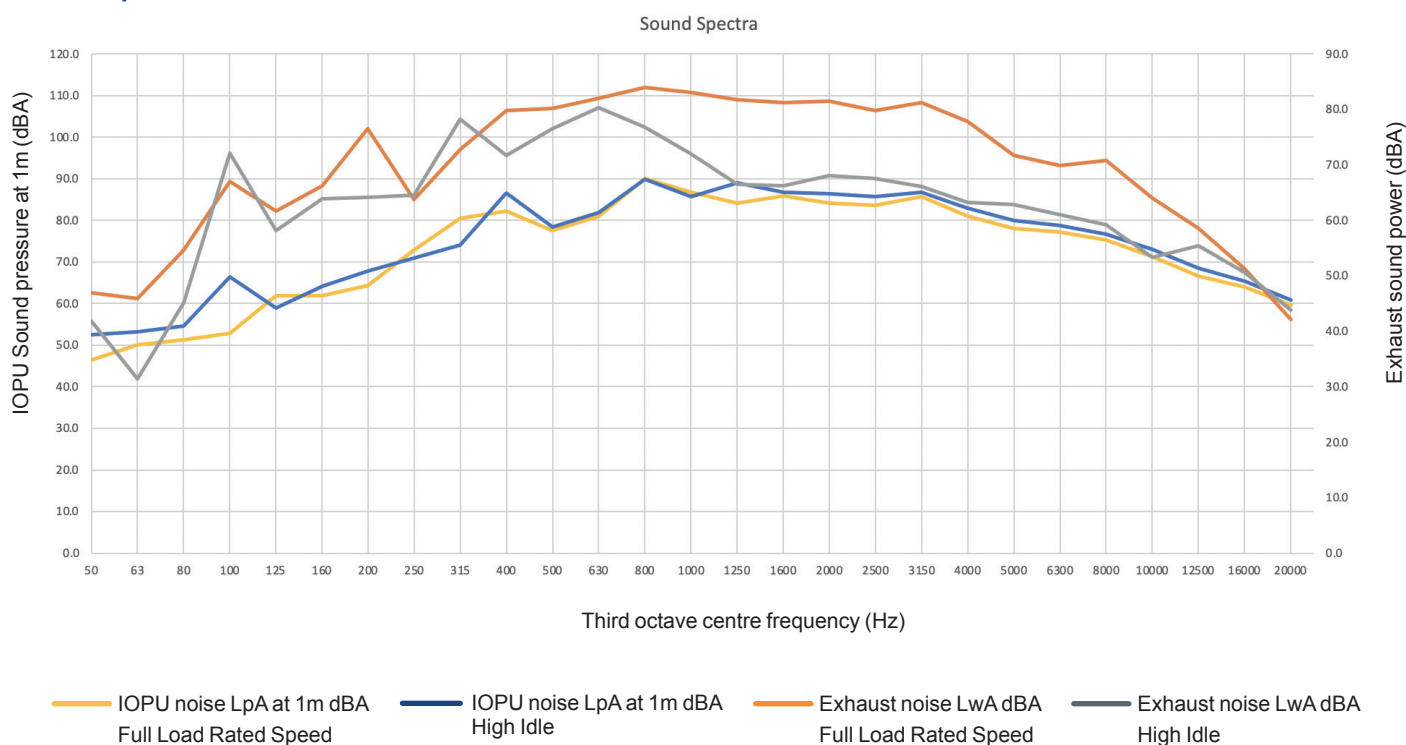
13. Sound power reference level: 1pW.

Spectral data - Pusher Fan, option M0042

¹/₃ Octave sound data for the IOPU, average of all microphones, and exhaust outlet noise level at turbocharger outlet.

	Third octave centre frequency (Hz)																											
	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8k	10k	12.5k	16k	20k	
Exhaust Noise L _{WA} dBA FLRS	47.0	45.9	54.7	67.0	61.7	66.2	76.5	63.7	72.7	79.8	80.2	82.0	84.0	83.1	81.7	81.2	81.5	79.8	81.2	77.8	71.8	69.8	70.8	64.0	58.5	51.2	42.1	
Exhaust Noise L _{WA} dBA High Idle	41.9	31.4	45.1	72.1	58.1	63.9	64.2	64.5	78.2	71.7	76.5	80.3	76.8	72.0	66.4	66.2	68.1	67.5	66.1	63.3	62.9	61.0	59.2	53.3	55.4	50.6	43.9	
IOPU noise LpA at 1m dBA FLRS	46.5	50.1	51.3	52.9	61.9	61.9	64.4	72.9	80.5	82.3	77.6	81.1	90.0	86.8	84.2	85.8	84.1	83.6	85.7	81.1	78.1	77.1	75.3	71.3	66.7	64.0	59.7	
IOPU noise LpA at 1m dBA High Idle	52.5	53.1	54.7	66.4	58.9	64.2	67.8	70.9	74.1	86.5	78.4	81.8	89.9	85.7	89.0	86.8	86.5	85.7	86.8	82.9	80.0	78.8	76.7	73.0	68.5	65.3	60.9	

Sound spectra



Noise data - Puller Fan, option M0043

Noise data of the IOPU, this excludes exhaust outlet noise except where specifically stated, measured in a semi-anechoic environment. Measurements taken in accordance with ISO 6798:1995.

IOPU noise level

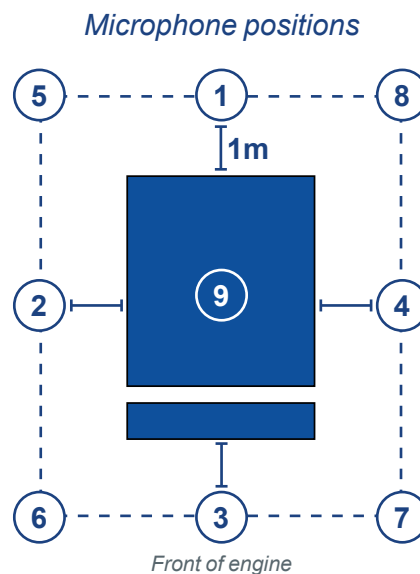
Average sound pressure level ^{11,12} (L_{pA}) at 1m (dBA)	
Full load rated speed (FLRS)	High Idle
92.1	94.2

Exhaust noise level at turbocharger outlet

Exhaust sound power level ¹³ (L_{WA}) (dBA)	
Full load rated speed	High Idle
92.1	85.5

Sound distribution around IOPU

Position (reference diagram)	Sound pressure level (L_{pA}) at 1m (dBA)	
	FLRS	Peak torque
1	91.4	92.8
2	93.2	95.8
3	93.7	96.6
4	95.6	97.5
5	90.1	91.1
6	90.0	92.7
7	89.5	92.6
8	87.8	90.0
9	94.1	96.0



11. Sound pressure reference level: 20 μ Pa.

12. For engine, average sound pressure level to sound power conversion add 15.6 dB.

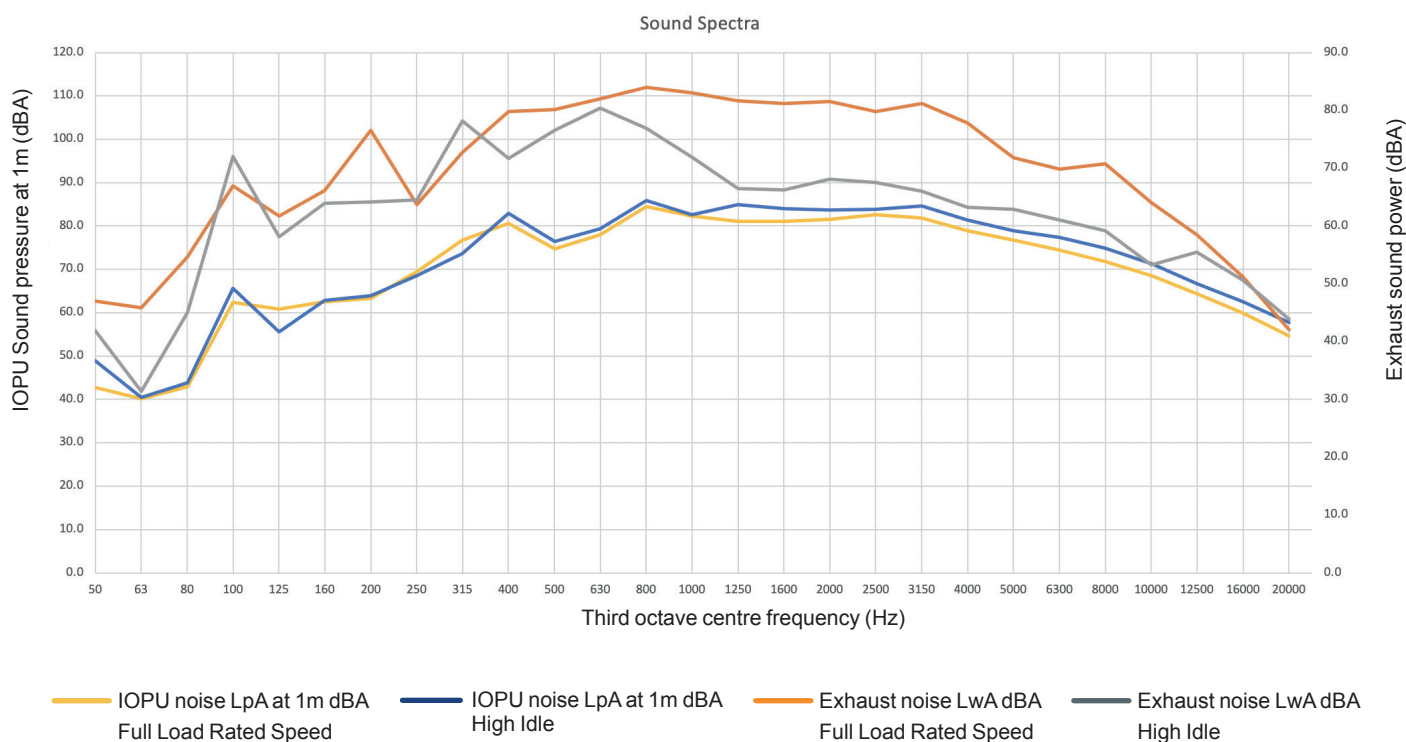
13. Sound power reference level: 1pW.

Spectral data - (Puller Fan, option M0043)

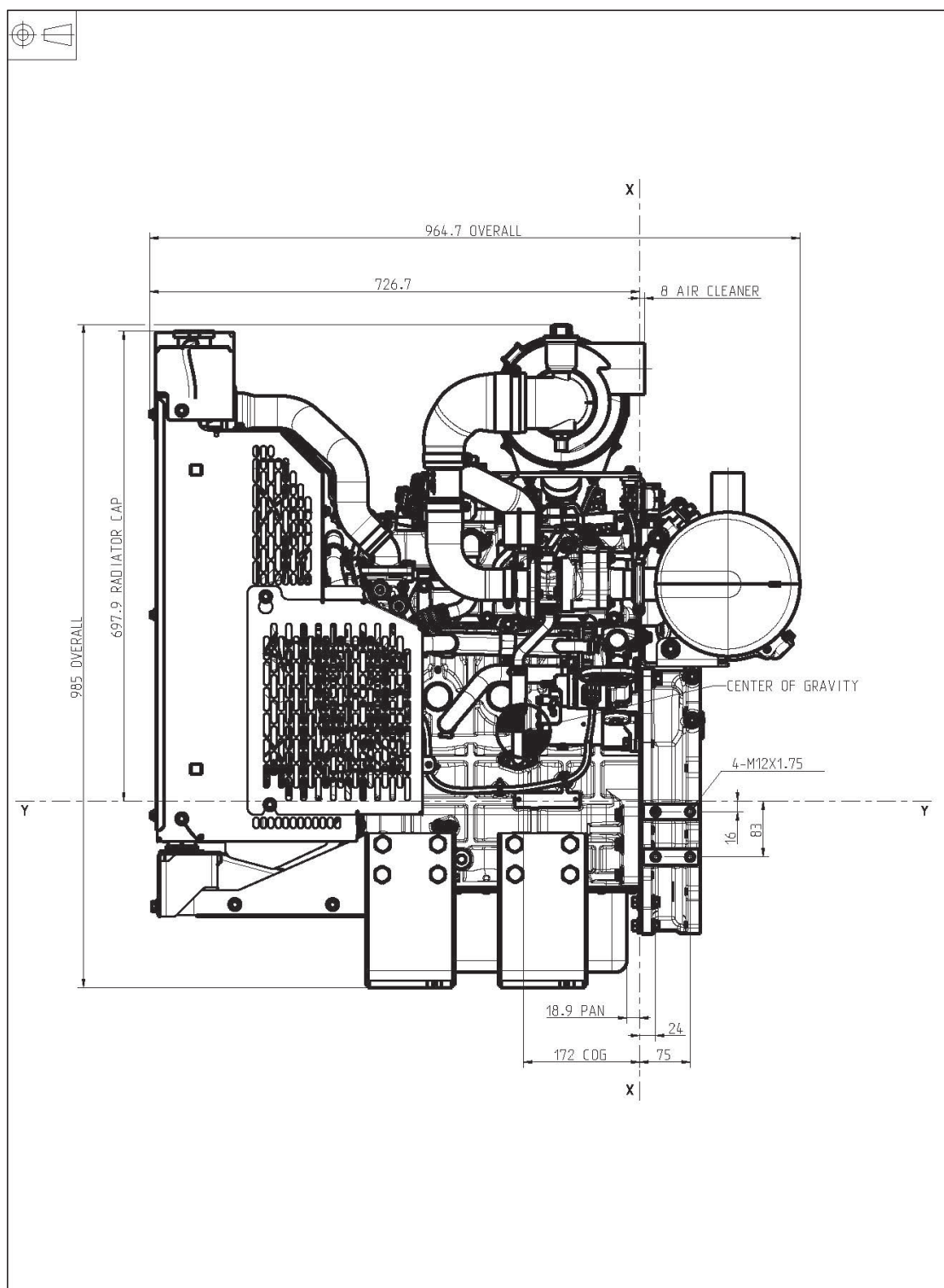
¹/₃ Octave sound data for the IOPU, average of all microphones, and exhaust outlet noise level at turbocharger outlet.

	Third octave centre frequency (Hz)																										
	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8k	10k	12.5k	16k	20k
Exhaust Noise L _{WA} dBA FLRS	47.0	45.9	54.7	67.0	61.7	66.2	76.5	63.7	72.7	79.8	80.2	82.0	84.0	83.1	81.7	81.2	81.5	79.8	81.2	77.8	71.8	69.8	70.8	64.0	58.5	51.2	42.1
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IOPU noise LpA at 1m dBA FLRS	42.8	40.2	42.9	62.4	60.8	62.6	63.4	69.5	76.7	80.7	74.8	78.0	84.4	82.3	81.0	81.1	81.5	82.6	81.8	79.0	76.7	74.5	71.7	68.6	64.3	59.9	54.6
IOPU noise LpA at 1m dBA High Idle	48.9	40.5	43.8	65.6	55.6	62.8	63.9	68.5	73.6	82.9	76.5	79.4	85.9	82.7	85.0	84.1	83.8	83.9	84.7	81.4	78.9	77.3	74.9	71.3	66.7	62.6	57.8

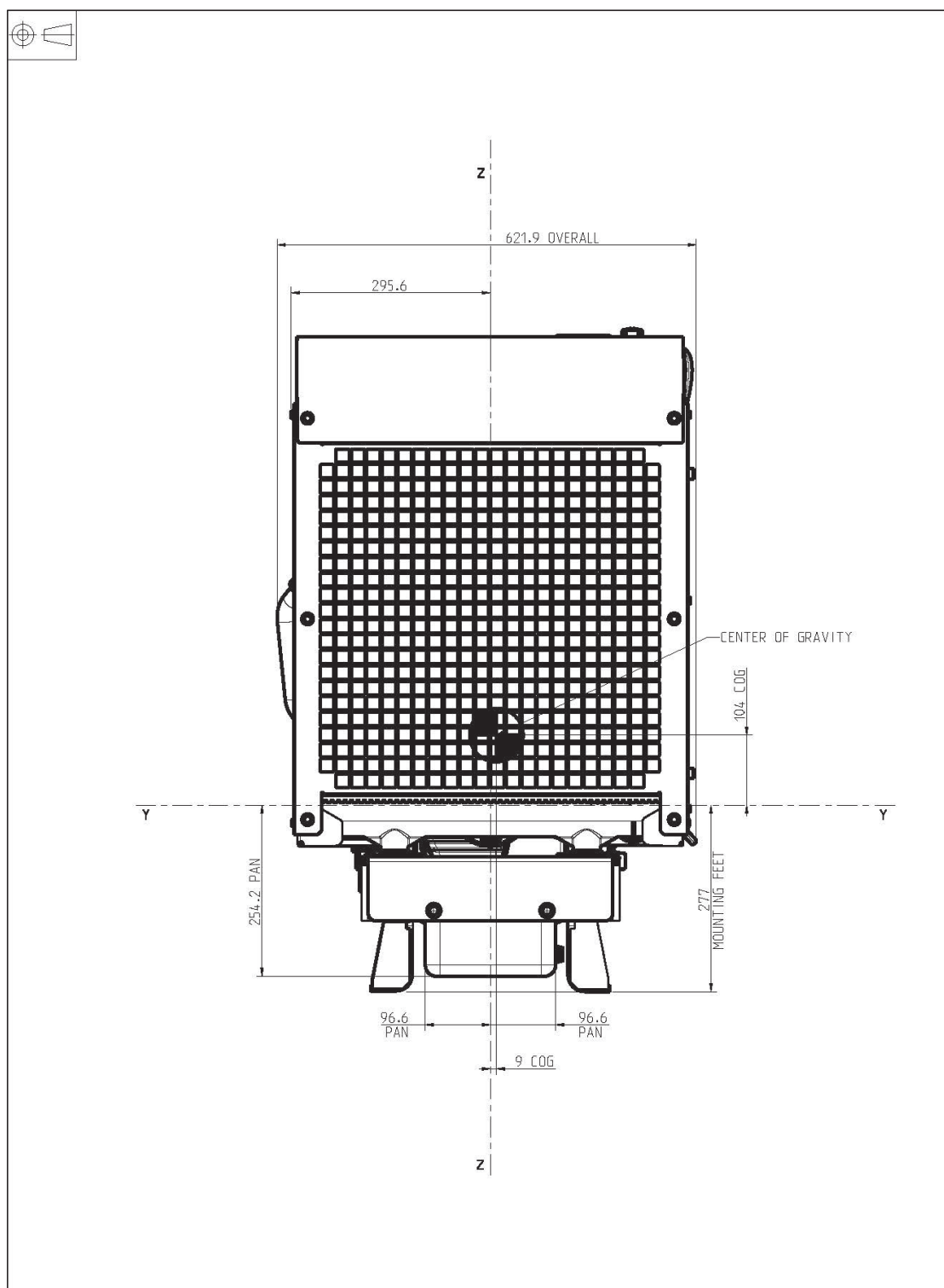
Sound spectra



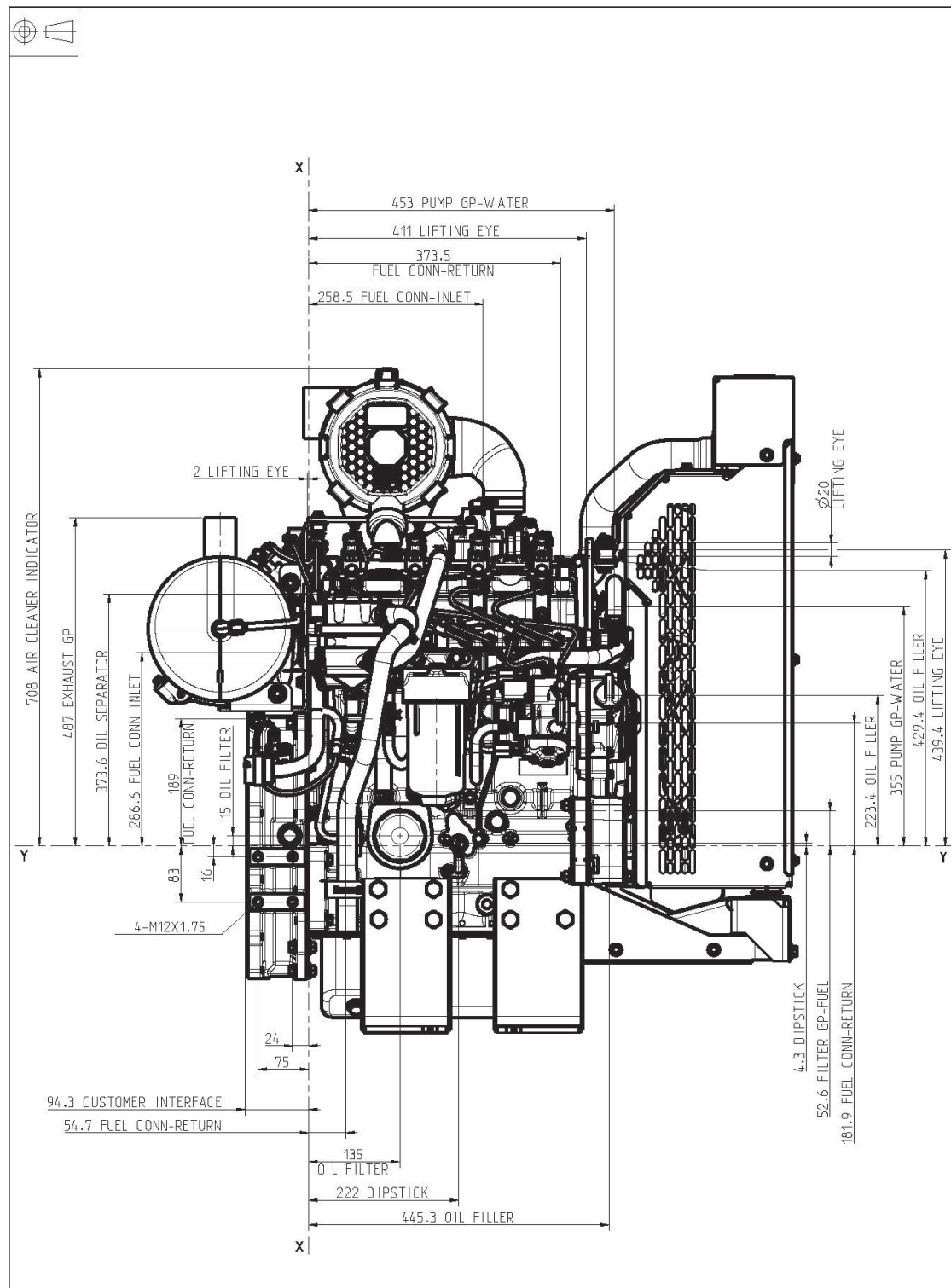
404J-E22T - Left hand view



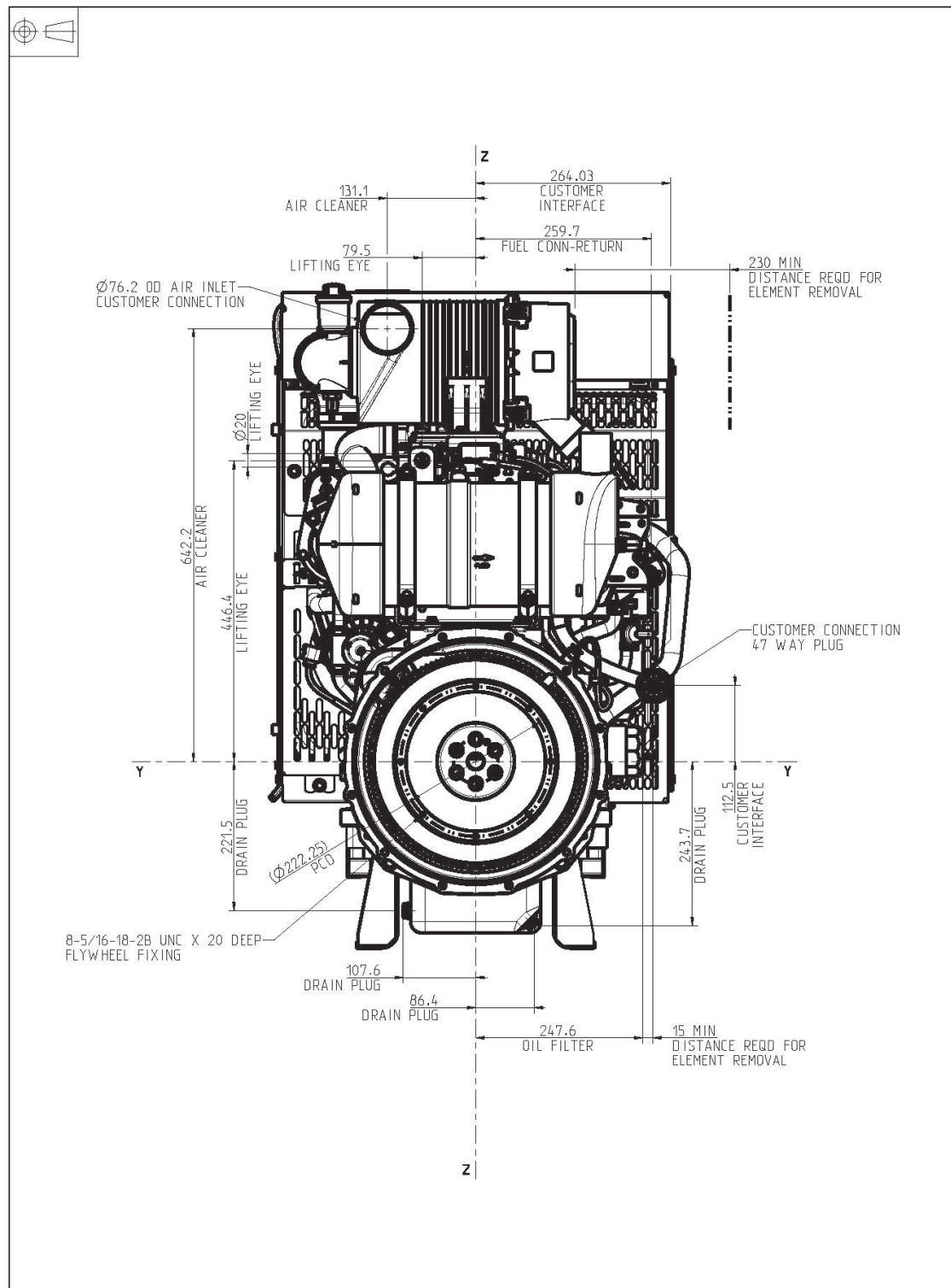
404J-E22T - Front view



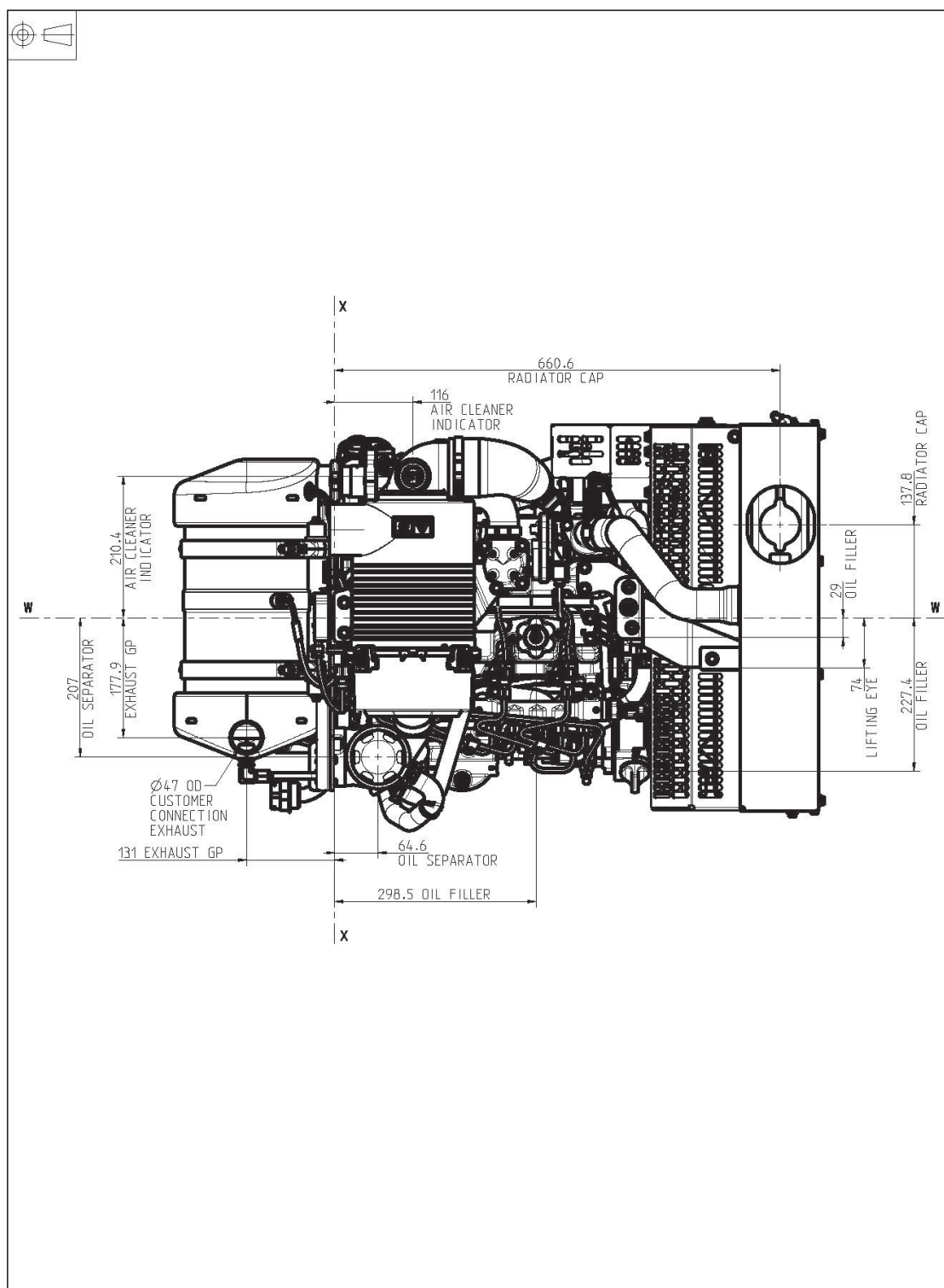
404J-E22T - Right side view



404J-E22T - Rear view



404J-E22T - Plan view



404J-E22T - Bottom view

